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MOUNT PIPER GRASSLANDS: PITFALL TRAPPING OF ANTS AND INTERPRETATION OF HABITAT VARIABILITY

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Abstract

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Ants were sampled by pitfall trapping in grassland patches near Mount Piper education reserve, Victoria. Ten surveys, from February to July 1994, yielded 18 genera and 36 morphospecies, with considerable differences between the seven sites. The results suggested highly localised mosaic variation with respect to different functional groups. Ranking of sites on generic diversity usually coincided with morphospecies on most of the sites, from the 'most natural' to the 'most degraded' and the more abundant and widespread ants constitute a core taxon suite which can grossly characterise the ant assemblage of the grasslands.

Introduction

The rationale of ant surveys at Mount Piper, Broadford, Victoria, was outlined by Hinkley and New (1997) as a component of defining the conservation needs of rare lycaenid butterflies whose caterpillars are myrmecophilous (see also Britton et al., 1995). Searches for particular ant species have been extended beyond the central reserve area into adjacent properties, and this paper focuses on one of these, the 100 ha block 71C along the eastern border of Mount Piper (Fig. 1). The block contains substantial areas of grassland, and has been grazed heavily by domestic stock (predominantly sheep) and kangaroos. Many of the grassland patches are separated by eucalypt-wooded ridges, and some have been invaded by exotic plants, predominantly the grass *Holcus lanatus*. This paper reports an attempt to define the ant fauna of these grasslands, as an adjunct to the survey of the Mount Piper reserve by Hinkley and New, and to assess and compare the ant assemblages of 'more natural' and 'more disturbed' grassland patches to determine the extent of heterogeneity over the area and evaluate the worth of ants as indicators of grassland disturbance, manifest by invasion by exotic grass species.

Methods

Five sites, two subdivided to provide a total of seven trapping areas, were used for placement of pitfall traps (plastic cups 7.4 cm diameter, 8.8 cm deep) in grids of 20 (5 × 4, 5 m spacing between traps) over the period February–July 1994. Traps contained 70% alcohol and ethylene glycol, and were emptied at approximately fortnightly intervals so that trapping was continuous over the survey period. Ants were separated and identified to genus and morphospecies using

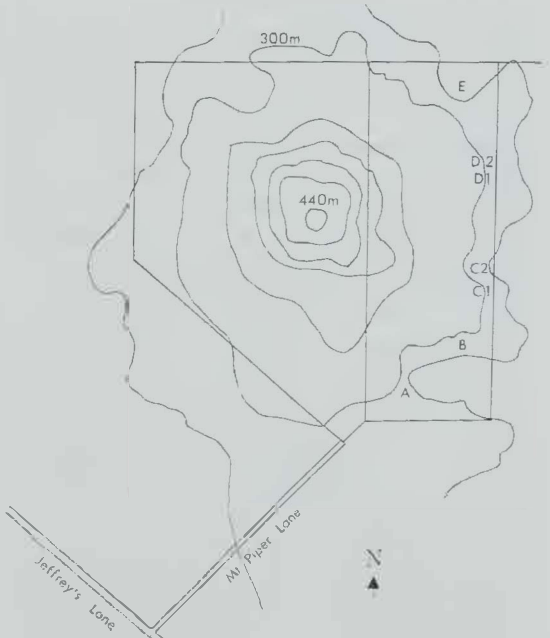

Figure 1. Mount Piper and Block 71C (the rectangular area to the right (east) of the mountain), showing sites A-E, used for pitfall trapping grids in this survey.

keys by Andersen (1991), Hölldobler and Wilson (1990), Shattuck (1992), Bolton (1994) and several revisionary studies. The five sites (A–E in Fig. 1, with C_1, C_2 and D_1, D_2 representing separate grids within the topographically complex sites C and D) had all been grazed heavily by sheep in the year preceding the survey. Direct searches for ants were also made on each site.

Sites were ranked on 'degree of disturbance', representing separate vegetation cover and predominance of native grasses (*Danthonia*) or exotic *Holcus* (equated to higher disturbance). In sequence from 'most natural' to 'most disturbed', the sequence is D_2, C_1, A (native grasses), D_1/E, C_2, B (*Holcus*) so that two contrasting series are included.

Analysis is noted in context. Allocation to functional groups (at generic level) follows Andersen (1990).

Results

Overview

The 12161 ants captured (Table 1) included 36 morphospecies and representatives of 20 genera. Considerable variation occurred on all seven trapping grids, and 11 morphospecies were recorded only at single sites.

Iridomyrmex vicina comprised more than 60% of all ants captured and, at the other extreme, eight morphospecies were represented by individuals. Direct searching did not yield any species not captured by the traps. Analysis by frequency of capture, rather than simple abundance, implied less domination by *I. vicina*. Ranking species by 'trapping events' (7 sites $\times$10 occasions = 70 trapping events, treating a grid as a sampling unit) gave the sequence of *Pheidole* sp. (59 events), *Rhytidoponera tasmaniensis* (53), *Camponotus consobrinus* (41), *I. vicina* (37). *R. tasmaniensis* comprised only 5.7% of total ants and *Pheidole*, nearly 16%.

Diversity differed between sites. At the extremes, site A yielded 30 morphospecies in 16 genera and site E, 11 morphospecies in 7 genera. Ranking of sites by generic diversity (high-low : A, C_2, C_1, D_1/D_2, B/E) partially coincided with ranking by species diversity (A, C_2, C_1, B, D_2, D_1, E), especially for the richer sites.

New species and site records accumulated throughout the survey, but a high proportion of taxa (26/36 morphospecies) occurred in the first two-week period, with the highest augmentation (four morphospecies) in the next fortnight. Two morphospecies were detected for the first time in the last trapping period. In general, and reflecting seasonal activity, ant diversity was greatest early in the trapping sequence and genus and species richness declined to about half the peak levels over intervals 8 and 9 (Table 2). Extremes over the survey were 13 genera/27 morphospecies (interval 2) and five genera/10 morphospecies (interval 8). Incidence of particular taxa also varied over the course of the survey. As examples, *Stigmacros* occurred only in the first five trap sets, and *Melophorus* and *Meranoplus* were absent in sets 8–10. *Stigmacros* occurred only at site A, and in small numbers, whereas *Melophorus* showed a clear pattern of declining activity manifest in the number of sites (a) and the number of individuals captured (b), so that a/b for successive intervals from 1 was 5/96, 4/35, 3/27, 1/1, 3/6, 0/0, 1/1.

Site condition

The three native sites supported 30 (A), 20 (C_1) and 14 (D_2) ant morphospecies, and the four *Holcus* sites had 17 (B), 22 (C_2), 13 (D_1) and 11 (E), so that the range of values in each series is high, and the series overlap. The paired and contrasting C and D subsites, only a few tens of metres apart, did not differ significantly from each other in diversity: C_1 and C_2 shared 14 (of 26) morphospecies, and D_1 and D_2 10 (of 18). Ten species occurred on all three native sites, and a further 10 were found on two of them. Six of the former group were trapped also on all four *Holcus* sites, these species being *I. vicina, C. consobrinus, C. myoporus, Melophorus, R. tasmaniensis* and *Pheidole*. Three (*I. gracilis, Notoncus enormis, Monomorium*) were found on two of them. The tenth (*Meranoplus*) was found on only one *Holcus* site, but was also uncommon on the *Danthonia* sites.

N. ectatommoides occurred on all four *Holcus* sites and two native sites, and *R. victoriae* on two sites in each category. Fifteen of 16 taxa (the sole exception being *Polyrhachis*) on two, three or four *Holcus* sites were found also on two or three native sites. Total representation was 33 morphospecies (native sites) and 28 morphospecies (*Holcus* sites).

Species shared between each pair of sites (Table 3) were usually a high proportion of the total for the sites and values for a simple Sorenson index of similarity are correspondingly high (Table 3). The ants of site E are fully a subset of those at A and C_2; the highest similarity is between sites E/D_1 and the lowest between C_1/E. Ranking of sites by diversity differed between sampling occasions (Table 2).

Table 1. Grassland ants at Mount Piper, 1994: species list and incidence (√) at each trap site (A-E). Taxa represented by single individuals are underlined.

	A	B	C_1	C_2	D_1	D_2	E	No. sites
Myrmecia 'picta'	√		√	√				3
M. 'pilosula'	√		<u>√</u>		<u>√</u>			3
Meranoplus	√		√	√		<u>√</u>		4
Mayriella	√							1
Podomyrma					<u>√</u>			1
Pheidole	√	√	√	√	√	√	√	7
Monomorium	√		√	√		√	√	5
Polyrhachis	√	<u>√</u>		√				3
Camponotus 'claripes'	√	√	√	√	√		<u>√</u>	6
C. 'consobrinus'	√	√	√	√	√	√	√	7
C. 'innexus'	√		<u>√</u>	√				3
C. 'intrepidus'		<u>√</u>						1
C. 'myoporus'	√	√	√	√	√	√	<u>√</u>	7
C. 'nigroaeneus'	√	√	√	<u>√</u>				3
C. 'suffusus'	<u>√</u>							1
C. 'rubiginosus'	√	√						2
C. sp.	√	√	√	√				4
Stigmacros	√							1
Myrmecorhynchus emeryi	<u>√</u>							1
Notonocus 'enormis'	√	√	√		<u>√</u>	√		5
N. 'ectatommoides'	√	√		√	√	√	√	6
Melophorus	√	√	√	√	√	√	√	7
Amblyopone	<u>√</u>							1
Rhytidoponera 'aspera'				√		√		2
R. 'tasmaniensis'	√	√	√	√	√	√	√	7
R. 'metallica'	<u>√</u>			√	√	√	<u>√</u>	5
R. 'victoriae'	√	√	√	√				4
Platythyrea			<u>√</u>					1
Heteroponera	<u>√</u>							1
Dolichoderus 'doriae'				<u>√</u>				1
Leptomyrmex 'erythrocephalus'	<u>√</u>							1
Iridomyrmex 'bicknelli'	√	√	<u>√</u>					3
I. 'gracilis'	√	√	√	√		√		5
I. 'purpureus'	<u>√</u>			√	√	√	√	5
I. 'vicina'	√	√	√	√	√	√	√	7
Doleromyrma darwinianus				<u>√</u>	√			2

Table 2. Ant richness (no. of genera/no. of species) at each grassland site (A–E) and sampling occasion (1–10, as fortnightly intervals from February-July) near Mount Piper, 1994.

	Sampling occasion (genera/species)									
Site	1	2	3	4	5	6	7	8	9	10
A	12/20	11/21	11/17	8/15	9/15	5/8	6/10	3/3	3/3	6/9
B	6/12	6/11	6/11	5/10	6/8	6/10	5/10	4/6	4/5	4/6
C_1	7/11	8/14	9/15	5/6	4/5	3/5	8/12	4/6	2/2	6/10
C_2	8/14	7/15	5/9	6/9	5/6	6/7	5/8	5/6	3/4	4/4
D_1	6/9	5/8	5/6	0/0	3/3	6/7	5/8	3/3	4/5	5/7
D_2	6/10	7/12	4/4	5/5	5/7	3/3	4/6	2/2	0/0	2/3
E	4/4	7/7	1/1	1/1	5/6	2/2	2/2	3/3	2/2	5/5
All	12/26	13/27	11/22	10/20	10/20	8/18	9/21	5/10	6/10	9/16

Table 3. Number of species of ant (top) and Sorenson index of similarity (S = 2j /a+b, where j is number of shared species and a, b, are number of species in A, B, bottom) shared between grassland sites (A–E), Mount Piper 1994.

	No. shared species						
	A	B	C_1	C_2	D_1	D_2	E
A		16	17	19	12	13	11
B	0.68		13	13	9	9	8
C_1	0.68	0.70		16	10	10	8
C_2	0.73	0.67	0.76		10	13	11
D_1	0.56	0.60	0.61	0.57		10	10
D_2	0.59	0.58	0.59	0.72	0.74		10
E	0.54	0.57	0.52	0.67	0.83	0.80	

Table 4. Functional grouping of ant species from grassland sites A–E, given as number (%) of total species.

	Site							
Functional Group	A	B	C_1	C_2	D_1	D_2	E	Total
Dominant *Iridomyrmex*	5(18)	4(22)	4(20)	3(14)	1(8)	4(26)	2(20)	6(17)
Subordinate 'Camponotinae'	9(32)	8(44)	6(39)	7(33)	3(23)	2(13)	3(30)	10(28)
Hot climate specialists	2(7)	1(5.5)	2(10)	2(10)	1(8)	2(13)	1(10)	2(5.5)
Cold climate specialists	3(11)	2(11)	1(5)	1(5)	3(23)	2(13)	1(10)	4(11)
Cryptic	1(3.5)	—	—	1(5)	—	—	—	2(5.5)
Subcryptic	2(7)	—	—	—	—	—	—	2(5.5)
Opportunists	4(14)	2(11)	2(10)	4(20)	3(23)	3(20)	2(20)	5(14)
Generalised Myrmicinae	2(7)	1(5.5)	2(10)	2(10)	1(8)	2(13)	2(20)	2(5.5)
Large solitary foragers	1(3.5)	—	3(15)	1(5)	1(8)	—	—	3(8)

Functional groups

Analysis of functional groups (Table 4) revealed few major differences between the most natural and most disturbed sites by the most abundant groups. 'Subordinate Camponotinae' were the predominant group at five sites, co-predominant at one (with 'opportunists' at D) and was minor only at D_2. Cryptic and subcryptic taxa were scarce or absent, perhaps in part because they are not amenable to pitfall trapping. 'Large solitary foragers' (*Myrmecia*) were poorly represented throughout the series.

Discussion

The ant morphospecies found are a subset of the ants trapped in nearby wooded areas (Hinkley and New, this volume) and only one additional species (*Rhytidoponera 'metallica'*) was found on the grasslands. The assemblages are far less diverse than those on woodland sites, and most grassland sites supported fewer than 20 species (maximum of 30 at A). Unlike the woodland survey a high proportion of taxa was captured very early in the trapping sequence and (neglecting singleton incidences — Table 1), many species occurred on several sites with little apparent discrimination in relation to dominant grass species. However, because of the previous grazing history, it is likely that all sites are 'disturbed' and the broad range of such species may simply reflect that they are not specialised ecologically and that the assemblages may formerly have been more diverse. *Rhytidoponera*, for example, are 'opportunist' taxa, and *R. tasmaniensis* was widespread. Overall disturbance may be more significant to ants than simple replacement of native by exotic grass species. However, these assemblages appear to be easier to sample and define than are the more diverse woodland faunas — but no second sampling sequence equivalent to that taken by Hinkley and New was undertaken, and such inferences must remain tentative. Indeed, *Rhytidoponera* are often dominant as broadly adapted species in mesic ant assemblages (such as at Wilsons Promontory: Andersen 1986a, b).

Nevertheless, it is clear that the same ant species occurred in grossly similar ecological balance (as indicated by functional groups) on the seven sites. It is possible to define a 'core taxon suite' which can be used to define the ant assemblages of grasslands in this region and constitute a basis for comparison with other grassland sites, but also to recognise that the mosaic nature of such assemblages will assure that many highly localised morphospecies will be present and render each site distinct from others. Because such variation is hard to quantify without extensive sampling, surveys of grassland ants should include trapping at several sites even if the vegetation appears to be homogeneous throughout the area.

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