ASPECTS OF THE HABITAT RELATIONSHIPS OF MADEIRAN COLEOPTERA

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With 2 figures

ABSTRACT. Coleoptera were collected on Madeira and its associated islands during several expeditions from Manchester. The sites at which different samples were collected were analysed for their similarities based on the presence or absence of species. The results identify two major groups of sites, each containing two subgroups and one or more sites with minor association. These groups fall into categories which may be explained with reference to the geographical distribution as well as the habitat characteristics of the sites concerned.

INTRODUCTION

Previous work has indicated that the various island groups in the Madeiran Archipelago can be grouped on the basis of their coleopterous fauna (WHEATER,1993). These results have been shown to be consistent over time; when data was analysed from the classical works by WOLLASTON (1857, 1865 and 1871), recent work by ERBER & HINTERSEHER (1988) and collections from the Manchester Expeditions (1981-1988) similar results were found. These suggest that on the basis of the presence/absence of beetle species, the Porto Santo Island group show greater similarity to the Deserta Islands than to Madeira itself. Where more data was available (ie. the Manchester collections and that from ERBER & HINTERSEHER 1988) other patterns emerged. One of the most interesting was the closer link of the Madeiran peninsula to the Deserta Islands than to the rest of Madeira. These patterns are perhaps not surprising given the sparse vegetation cover of Porto Santo and its satellite islands, the Deserta Islands and the Madeiran peninsula which may influence the coleopterous fauna. The large vegetational and altitudinal ranges of habitats on Madeira proper may be a major influence in distinguishing its Coleoptera from the other islands considered.

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Since the earlier analysis, several further collections have been made on Madeira enabling the whole collection to be examined in greater detail (1981-1991). Such data may be examined from a consideration of the habitats involved and an examination of the species held in common (much of the latter will form the basis of further work). This study concentrates on an initial investigation into the habitat relationships of Coleoptera from Madeira and the immediately associated islands, including the Deserta Islands.

METHODS

Specimens were collected by a large number of participants on a series of expeditions and other visits to Madeira during the period 1981 to 1991. A variety of methods of collection were employed including hand sorting leaf litter and other debris (including under logs and stones), use of pitfall (Barber) traps, sweeping vegetation and casual collections. Because of this quantifying the data in abundance terms is not possible for all of the collections. However, species presence or absence are sufficient to examine the relationships between habitats based on this fauna. The relationships were examined using cluster analysis; the Maximum Likelihood similarity method developed by COOK (1978). This utilises presence and absence of species from pairs of sites and links them in terms of units of standard error.

The proportions of common species and the numbers of species found were examined both between and within the major groups using a rank means test (MEDDIS, 1984). Common species were defined as species occurring in 8 or more sites. This is the level at which species occurrence exceeds the mean occurrence of 7.34 species per site.

The sites which were sampled are spread over a wide area of Madeira (see figure 1), although most are mainly the east. Many of the sites were sampled over several years and often at different times of the year. Some of the data from sampled sites are combinations from sites in the same locality and with similar vegetation types.

RESULTS AND DISCUSSION

An examination of the Madeiran data shows two main groups of sites (see figure 2). These are:

A) the peninsula and some madeiran sites;

B) the rest of the madeira sites plus the Deserta Islands and the islands at the end of the peninsula.

Group A habitats:

Looking in more detail it can be seen that the sites in the first group form two main sub-groups:

a) peninsula sites (L1-L8);

b) sites spread around Madeira which have had a heavy human influence (M2, M4, M9, M12, M14 and M16). These include the park in Funchal (M14), an area of waste ground in Santa Madelana (M16) and one in Santa de Serra (M9), an area at Queimadas (M12) next to a car park, and sites in Achado do Teixeira (M2) and Faja da Nogueira (M4), both of which are near to relatively heavily used access routes.

There is an additional single site linked to group A which is a beach site at Faial (M11).

Group B habitats:

The sites in the second group split into two main sub-groups:

a) island and eastern sites (D1, L9, M1, M6, M7, M8, M10, M19, M20 and M21). These include the Deserta Islands (D1), Ilheu de Agostinho and Ilheu de Fora (L9) (island sites) and Lamaceiros (M8), and Poiso (M6) (eastern sites);

b) high altitude sites (M3, M5, M13, M15, M17, M22, M24 and M25). These include sites on the Paul da Serra (M17, M22, M25), Encumeada (M24) and Arieiro (M3). Two sites associated loosely with the last group are at lower altitudes, Vale de Paraiso (M5) and Boca do Risco (M13).

There are an additional two sites which are associated with group B albeit at low levels of similarity. These are Sau Jorge (M19) and Ovil (M23) on the Paul da Serra.

General considerations

Localised similarities can be seen in some closely situated areas. M8, M19 and M20 are all near to Lamaceiros and M8, M19 and M20 are all on the Paul da Serra. However, not all similarities are due to the close geographical proximity of sites, there are also localised differences. M19 at Santa de Serra falls into a different group to the other sites near to Lamaceiros.

These data suggest that localised distributions are a combination of both habitat and geographical features.

At least for some groups of sites ubiquitous species such as *Nesarpalus gregarius* and *Harpalus tenebriosus* may swamp the influence of less frequently found species such as *Calosoma maderae*.

In addition, there is some evidence that, at least for one of the groups (group B) there is a significant difference between the subgroups in the ratio between commonly found species present and less common species ($H = 10.275$, $df = 2$, $p = 0.006$). No significant difference were found when analysing the numbers of species, or between the major groups or within group A for the proportion of common species.

It appears that the island and eastern sites feature a greater proportion of frequently found species than the high altitude sites. Although both subgroups contain sites with relatively sparse vegetation, the latter subgroup may provide a greater range of vegetation types so having a greater proportion of less frequently found species.

Further collections and analysis may help to verify this position and it is intended to extend this work in order to examine the influence of disturbance on the coleopterous fauna of a wider range of habitats including those on Porto Santo.

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Figure 1

Key

D1 Deserta Islands

L1 Ponta do Furado
L2 Casa da Sardinha
L3 Ponta do Castelo
L4 Ponta do Buraco
L5 Ponta das Gaivotas
L6 Prainha
L7 Cabeco da Cancela
L8 Rocha da Faja
L9 Ilheu de Agostinho and Ilheu de Fora

M1 Machico
M2 Achada do Teixeira
M3 Arieiro
M4 Faja da Nogueira
M5 Vale de Paraiso
M6 Poiso
M7 Ribeiro Frio
M8 Lamaceiros
M9 Santo da Serra
M10 Porto da Cruz
M11 Ribeiro da Ametade
M12 Casa das Queimadas
M13 Boca do Risco
M14 Funchal
M15 Cabeco do Curral
M16 Santa Madalena
M17 Fonte do Bispo
M18 Sau Jorge
M19 Above Lamaceiros
M20 Below Lamaceiros
M21 Ribeiro Seco
M22 Paul da Serra
M23 Ovil
M24 Encumeada
M25 Ribeiro de Janella

D - Deserta Islands
L - Madeiran peninsula and islands
M - Madeira

Figure 1 - Sampling sites on Madeira and surrounding islands.

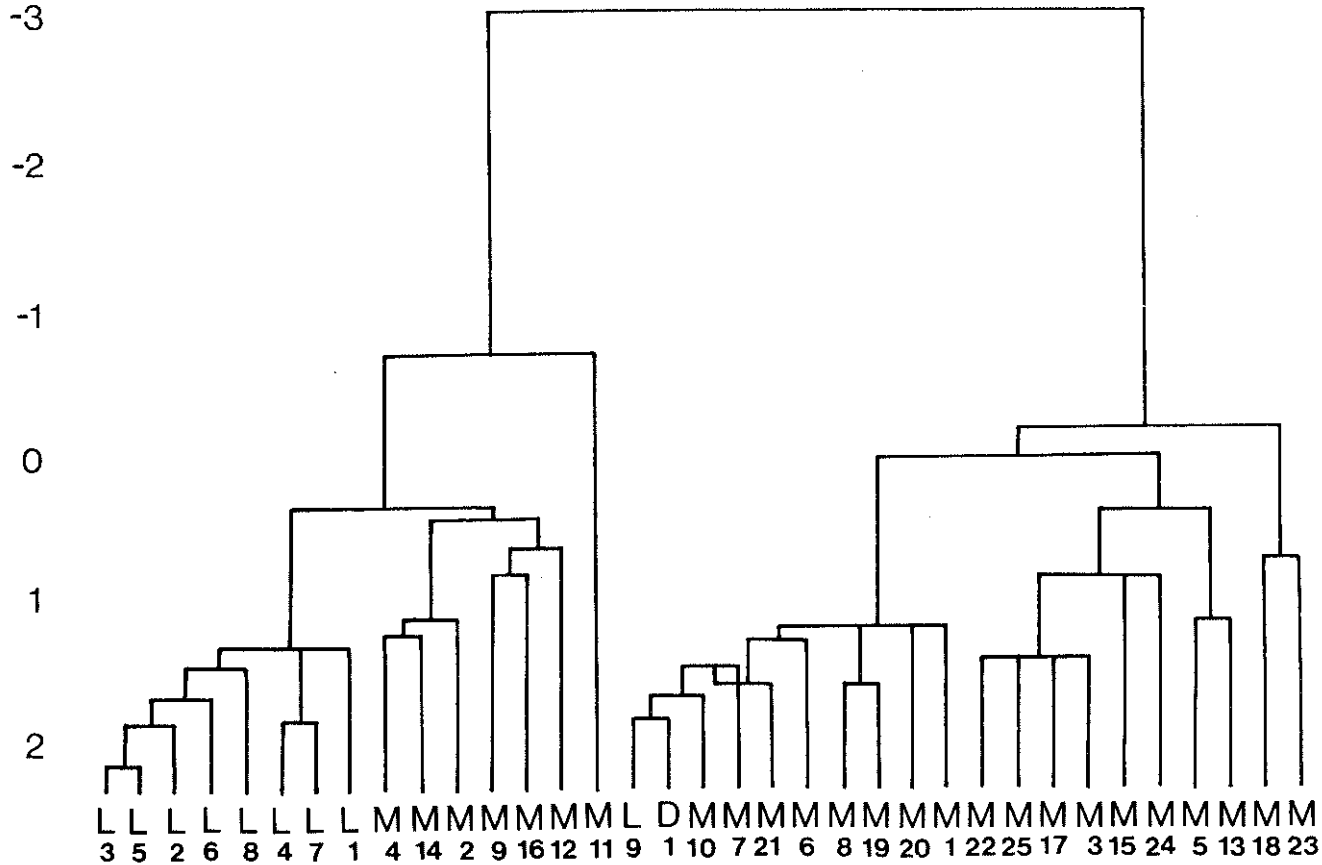

Figure 2 - Dendrogram of Maximum Likelihood Similarity between sites based on the presence/ absence of Coleoptera species.