Background studies for the interpretation of urban archaeological plant and animal remains

Archive report 2

Foul-matter insects in grazed turf soils

By H. Kenward

Environmental Archaeology Unit
University of York

Date of original: 30th September 1984

Note: *This report has been re-typed and re-formatted, with minor editorial corrections, from a poor original. Some statements which appear less viable in the light of later evidence, e.g. concerning waterside oxytelines in York's background fauna, have been left unchanged. The data appendix has been completely re-formatted and updated. This report was allocated* post hoc *as* Reports from the Environmental Archaeology Unit, University of York ***1984/06***. *HK 14th July 2008.*

Abstract

Death assemblages of insects (mostly Coleoptera) from soil in grazing land have been examined, with special reference to species associated with foul matter and dung. *Aphodius* species made up a large proportion of the foul-matter component, and other species which generally live in dung in large numbers were relatively rare as corpses. Some of the generalist decomposers together with the foul matter species form a group which would be found together as a living community in dung. These observations are applied to supposed dumps of soil in a Roman well at The Bedern, York, and to some other archaeological samples which may have included grassland soil. It is concluded that in each case the soil probably did develop in a grazed area.

1. Introduction

Interpretation of archaeological insect assemblages is based on extrapolation of the habitats and behaviour of species at the present day. However, habitat information alone is insufficient. Firstly, available records are inadequate. Secondly, and more importantly, data concerning the formation and structure of modern death assemblages are essential to an understanding of ancient ones.

The present study was prompted by questions posed during interpretation of the plant and insect remains from the fills of a Roman well at The Bedern, York (Kenward and Hall forthcoming). The flora and fauna were regarded as indicating that biota from grassland entered the well, and dumping of topsoil appeared the most likely mechanism. Scarabaeid dung beetles of the genus *Aphodius* were quite abundant: this was taken as evidence that animal dung had been deposited on the surface from which the dumped material was removed, the numbers of *Aphodius* being too large to be accounted for as background fauna (Kenward 1976; 1976) from a great distance. However, other species associated with dung were rather rare. A similar phenomenon had been encountered in a buried pre-Roman soil at the Skeldergate site (Hall *et al.* 1980) and in deposits formed during the later stages of the terrestrialisation of a medieval moat at Speke Hall, Merseyside (Tomlinson and Kenward, forthcoming). Another assemblage in which *Aphodius* were exceptionally abundant was recorded from Roman Carlisle (Kenward and Morgan forthcoming); the sample from which it was recovered was submitted by the excavator as a '?turf dump'. By contrast with these death assemblages, living communities in herbivore dung are rich in species and individuals of coprophages from a variety of families, principally Hydrophilidae and Staphylinidae, in addition to Scarabaeidae (see for example the studies by Hanski 1980, Koskela 1972 and Koskela and Hanski 1977).

Thus the following problem is posed: did the *Aphodius* in these archaeological samples originate selectively in background fauna or, when compared with living communities, are death assemblages formed in grazing land deficient in dung-feeding beetles other than *Aphodius* species?

2. Methods

Only a very limited study was possible. Sampling was carried out on Walmgate Stray, York (Grid Reference SE 617 506), an area of poor low-lying grazing land, on 2nd December 1983. The winter months were chosen for sampling so as, as far as possible, avoid bias from excess numbers of corpses of recently-active species. Two samples of turf and soil to a depth of 5 cm were collected (MOD 121 and MOD 122). MOD 121 represented turf where dung had become fully incorporated into the soil, and MOD 122 turf with some traces of intact dung on the surface. Subsamples of 1 kg of well-mixed material from each sample were processed using methods described by Kenward *et al.* (1980); prolonged boiling and coarse sieving were necessary to reduce the amount of plant debris which rose at the paraffin-flotation stage.

3. Results and discussion

The results of the analyses together with some statistics computed from them are presented in the Appendix. The samples gave assemblages whose major statistics are essentially similar. This consistency between the two sets of results provides some justification for basing arguments on what, if recovered from archaeological samples, would be regarded as rather small assemblages. Species richness was moderate and the outdoor component large, making up over a third of each assemblage. The overall rotting matter component (RT) accounted for over half of the individuals - quite a high proportion for as deposit formed in semi-natural surroundings.

The foul matter and dung component (Rf) was quite large: 12% and 19% of the individuals in the two samples. These are higher proportions than in most archaeological deposits, including many medieval cess-pits. In the Walmgate Stray samples, Rf species made up a relatively large proportion of the total rotting-matter component. In contrast to most urban archaeological assemblages, however, the foul matter component was dominated by *Aphodius* species, mostly *A. contaminatus* or *A. ?contaminatus*. These provides 8 of 14 Rf individuals in MOD 121 and 5 of 7 in MOD 122. Other Rf species were represent by single individuals, except for *Platystethus arenarius* (2 specimens in MOD 122).

While the assemblages were deficient in typical Rf species, there was a considerable number of individuals of some more eurytopic species which together with those categorised as Rf would make a community more typical of dung, although still with lower numbers relative to the *Aphodius* species, that would be found in a living population. Such species included *Anotylus complanatus*, *A. tetracarinatus*, *Megasternum obscurum* and *Megarthrus* sp.

The Rf component was smaller in the sample from soil with residual dung (MOD 122), but it is obviously unwise to attach much significance to differences between a single pair of samples.

It should be noted that many of the statistics for these modern assemblages can be found reproduced together in various urban archaeological ones. Some of the latter are perhaps similar in having been deposited in the open in areas of vegetation, but the vast majority clearly were not. However, in such cases there are usually abundant clues that a rich background fauna was present. In particular, the outdoor component typically contains many Oxytelinae (Staphylinidae) from damp ground and waterside habitats. These beetles appear to have been consistently present in the background fauna of ancient York (Kenward 1978, 7).

It is not the intention here to investigate the cause of the difference between living populations of foul-matter species and death assemblages, merely to record empirical observations. It is, however, possible that differences in the dispersal behaviour and length of life of the Scarabaeidae compared with other important coprophages of the families Hydrophilidae and Staphylinidae provide an explanation; the former are much more closely tied to dung, are perhaps more likely to die near it as spent adults and, because they live longer, are much more likely to die as pupating or active adults as a result of flooding or trampling.

4. Conclusions

The samples gave assemblages in which the foul-matter component was quite large, but dominated by *Aphodius* spp. There were also moderate numbers of more eurytopic species which include dung in their habitat range. A provisional characterisation of death assemblages in grazing land soil is thus provided. It appears that the archaeological assemblages dominated by *Aphodius* species may well have originated in grazing land; in particular, there is support for the hypothesis that the Roman well at The Bedern was filled by dumps which included topsoil from an area of grazed vegetation. These observations emphasise the shortcomings of attempts to classify species by their habitats, and especially the dangers of becoming mentally straight jacketed by ecological classifications. The need to adopt a community approach to interpretation of archaeological assemblages and the value of studies of modern death assemblages are underlined.

5. Acknowledgements

I am grateful to Frances Large for her assistance in collecting the samples and for carrying out the bulk of the practical work, and to my colleagues in the EAU for their comments on the first draft of the report.

6. References

Hall, A. R., Kenward, H. K. and Williams, D. (1980). Environmental evidence from Roman deposits in Skeldergate. T*he Archaeology of York* **14** (3), 101-56. London: Council for British Archaeology.

Hanski, I. (1980). The community of coprophagous beetles (Coleoptera, Scarabaeidae and Hydrophilidae) in northern Europe. *Annales Entomologici Fennici* 46, 57-73.

Kenward, H. K. (1975). Pitfalls in the environmental interpretation of insect death assemblages. *Journal of Archaeological Science* **2**, 85-94.

Kenward, H. K. (1976). Reconstructing ancient ecological conditions from insect remains: some problems and an experimental approach. *Ecological Entomology* **1**, 7-17.

Kenward, H. K. (1978). The analysis of archaeological insect assemblages: a new approach. *The Archaeology of York* 19 (1), 1-68 + plates I-IV. London: Council for British Archaeology.

Kenward and Hall (forthcoming): subsequently published as Kenward, H. K., Hall, A. R. and Jones, A. K. G. (1986). Environmental evidence from a Roman well and Anglian pits in the legionary fortress. *The Archaeology of York* 14 (5), 241-88 + Fiche 2. London: Council for British Archaeology.

Kenward and Morgan (forthcoming): subsequently published as Allison, E. P., Hutchinson, A., Jones, A. K. G., Kenward, H. K. and Morgan, L. M. (1991). *passim* in McCarthy, M. R., The structural sequence and environmental remains from Castle Street, Carlisle: excavations 1981-2. *Cumberland and Westmorland Antiquarian and Archaeological Society Research Series* **5** (fascicule 1); and Allison, E. P., Hutchinson, A., Kenward, H. K., Jones, A. K. G., and Morgan, L. M. (1991). *passim* in volume and fiche in McCarthy, M. R., The Roman waterlogged remains and later features at Castle Street, Carlisle: excavations 1981-2. *Cumberland and Westmorland Antiquarian and Archaeological Society Research Series* **5** (main volume).

Koskela, H. (1972). Habitat selection of dung-inhabiting staphylinids (Coleoptera) in relation to age of the dung. *Annales Zoologici Fennici* **9**, 156-171.

Koskela, H. and Hanski, I. (1977). Structure and succession in a beetle community inhabiting cow dung. *Annales Zoologici Fennici* **14**, 204-233.

Tomlinson and Kenward (forthcoming): subsequently published as Kenward, H. K. and Tomlinson, P. R. (1992). *Environmental analysis*, pp. 75-78 and 83-84 in D. Higgins, Speke Hall: excavations in the west range, 1981-82. *Journal of the Merseyside Archaeological Society* **8**, 47-84.

Appendix: Species lists and main statistics for two assemblages from samples of grazing land soil, Walmgate Stray, York.

Species lists in rank order. Abbreviations: n - number of individuals; ec - ecological code (see list at end of appendix).

MOD121 Weight: 1.00

Taxon	n	ec
Aphodius ?contaminatus	8	oa-rf
Enicmus sp.	6	rt-sf
Corticarina ?fuscula	6	rt
Xantholinus linearis or longiventris	3	rt-sf
Aleocharinae sp. B	3	u
Megasternum obscurum	2	rt
Anotylus sculpturatus group	2	rt
Stenus sp. A	2	u
Aleocharinae sp. A	2	u
Cryptophagus sp.	2	rd-sf
Atomaria sp. A	2	rd
Aridius bifasciatus	2	rt
Apion sp. A	2	oa-p
Sitona ?lepidus	2	oa-p
Heteroptera sp.	1	u
Bembidion lampros or properans	1	oa
Amara sp.	1	oa
Harpalus sp.	1	oa
Carabidae sp.	1	ob
Helophorus sp. A	1	oa-w
Helophorus sp. B	1	oa-w
Cercyon ?haemorrhoidalis	1	rf-sf
Cercyon ?terminatus	1	rf-st
Micropeplus ?fulvus	1	rt
Megarthrus sp.	1	rt
Anthobium ?atrocephalum	1	oa
Acrolocha sulcula	1	rt
Omalium sp.	1	rt
Platystethus arenarius	1	rf
Anotylus tetracarinatus	1	rt
Stenus sp. B	1	u
Tachyporus sp.	1	u
Colobopterus fossor	1	oa-rf
Aphodius sp. A	1	ob-rf
Atomaria sp. B	1	rd
Atomaria sp. C	1	rd
Halticinae sp. A	1	oa-p
Halticinae sp. B	1	oa-p
Apion sp. B	1	oa-p
Barypeithes sp.	1	oa-p

Sitona sp.	1	oa-p
Euophryum confine	1	l-sf
?Ceutorhynchus sp.	1	oa-p
Curculionidae sp.	1	oa

MOD122 Weight: 1.00

Taxon	n	ec
Aleocharinae sp. B	5	u
Aphodius contaminatus	5	oa-rf
Atomaria sp.	5	rd
Anotylus tetracarinatus	4	rt
Enicmus sp.	4	rt-sf
Tachyporus sp.	3	u
Helophorus sp.	2	oa-w
Platystethus arenarius	2	rf
Anotylus sculpturatus group	2	rt
Corticarina ?fuscula	2	rt
Bembidion lampros or properans	1	oa
?Pterostichus sp.	1	ob
?Harpalus sp.	1	oa
Carabidae sp. A	1	ob
Carabidae sp. B	1	ob
Cercyon sp.	1	u
Megasternum obscurum	1	rt
Megarthrus sp.	1	rt
Anotylus complanatus	1	rt-sf
Xantholinus longiventris	1	rt-sf
Staphylininae sp.	1	u
Tachinus sp.	1	u
Aleocharinae sp. A	1	u
Elateridae sp.	1	ob
Anobium punctatum	1	l-sf
Aridius bifasciatus	1	rt
Aridius nodifer	1	rt
Anthicus sp.	1	rt
Halticinae sp.	1	oa-p
Apion sp. A	1	oa-p
Apion sp. B	1	oa-p
Sitona sp.	1	oa-p
Euophryum confine	1	l-sf
Cidnorhinus quadrimaculatus	1	oa-p
Ceutorhynchus sp.	1	oa-p
Curculionidae sp.	1	oa
*Dermaptera sp.	1	u
*Diptera sp. (adult)	1	u

Main statistics: abbreviations explained at end of table.

	MOD121	MOD122
S	44	36
N	74	60
SOB	19	15
PSOB	43	42
NOB	28	20
PNOB	38	33
SW	2	1
PSW	5	3
NW	2	2
PNW	3	3
SD	0	0
PSD	0	0
ND	0	0
PND	0	0
SP	8	6
PSP	18	17
NP	10	6
PNP	14	10
SM	0	0
PSM	0	0
NM	0	0
PNM	0	0
ALPHAM	0	0
SEALPHAM	0	0
SL	1	2
PSL	2	6
NL	1	2
PNL	1	3
SRT	21	14
PSRT	48	39
NRT	45	31
PNRT	61	52
SRD	4	1
PSRD	9	3
NRD	6	5
PNRD	8	8
SRF	6	2
PSRF	14	6
NRF	13	7
PNRF	18	12
SSA	6	5
PSSA	14	14
NSA	14	8
PNSA	19	13
SSF	5	5
PSSF	11	14
NSF	13	8

PNSF	18	13
SST	1	0
PSST	2	0
NST	1	0
PNST	1	0
SSS	0	0
PSSS	0	0
NSS	0	0
PNSS	0	0
SG	0	0
PSG	0	0
NG	0	0
PNG	0	0

Abbreviations for ecological codes and statistics used for interpretation of insect remains in text and tables.

Lower case codes in parentheses are those assigned to taxa and used to calculate the group values (the codes in capitals). See Table 1 for codes assigned to taxa from the Pilestraede 8, Copenhagen, site. Indivs - individuals (based on MNI); No - number.

No taxa	S
Estimated number of indivs (MNI)	N
Index of diversity (α)	alpha
Standard error of alpha	SE alpha
No ‘certain’ outdoor taxa (oa)	SOA
Percentage of ‘certain’ outdoor taxa	PSOA
No ‘certain’ outdoor indivs	NOA
Percentage of ‘certain’ outdoor indivs	PNOA
No OA and probable outdoor taxa (oa + ob)	SOB
Percentage of OB taxa	PSOB
No OB indivs	NOB
Percentage OB indivs	PNOB
Index of diversity of the OB component	alphaOB
Standard error	SEalphaOB
No aquatic taxa (w)	SW
Percentage of aquatic taxa	PSW
No aquatic indivs	NW
Percentage of W indivs	PNW
Index of diversity of the W component	alphaW
Standard error	SEalphaW
No damp ground/waterside taxa (d)	SD
Percentage D taxa	PSD
No damp D indivs	ND
Percentage of D indivs	PND
Index of diversity of the D component	alphaD
Standard error	SEalphaD
No strongly plant_associated taxa (p)	SP

Percentage of P taxa	PSP
No strongly P indivs	NP
Percentage of P indivs	PNP
Index of diversity of the P component	alphaP
Standard error	SEalphaP
No heathland/moorland taxa (m)	SM
Percentage of M taxa	PSM
No M indivs	NM
Percentage of M indivs	PNM
Index of diversity of the M component	alphaM
Standard error	SEalphaM
No wood_associated taxa (l)	SL
Percentage of L taxa	PSL
No L indivs	NL
Percentage of L indivs	PNL
Index of diversity of the L component	alphaL
Standard error	SEalphaL
No decomposer taxa (rt + rd + rf)	SRT
Percentage of RT taxa	PSRT
No RT indivs	NRT
Percentage of RT indivs	PNRT
Index of diversity of RT component	alpha RT
Standard error	SEalphaRT
No ‘dry’ decomposer taxa (rd)	SRD
Percentage of RD taxa	PSRD
No RD indivs	NRD
Percentage of RD indivs	PNRD
Index of diversity of the RD component	alphaRD
Standard error	SEalphaRD
No ‘foul’ decomposer taxa (rf)	SRF
Percentage of RF taxa	PSRF
No RF indivs	NRF
Percentage of RF indivs	PNRF
Index of diversity of the RF component	alphaRF
Standard error	SEalphaRF
No synanthropic taxa (sf + st + ss)	SSA
Percentage of synanthropic taxa	PSSA
No synanthropic indivs	NSA
Percentage of SA indivs	PNSA
Index of diversity of SA component	ALPHASA
Standard error	SEALPHASA
No facultatively synanthropic taxa	SSF
Percentage of SF taxa	PSSF
No SF indivs	NSF
Percentage of SF indivs	PNSF
Index of diversity of SF component	ALPHASF
Standard error	SEALPHASF
No typical synanthropic taxa	SST
Percentage of ST taxa	PSST
No ST indivs	NST

Percentage of ST indivs	PNST
Index of diversity of ST component	ALPHAST
Standard error	SEALPHAST
No strongly synanthropic taxa	SSS
Percentage of SS taxa	PSSS
No SS indivs	NSS
Percentage of SS indivs	PNSS
Index of diversity of SS component	ALPHASS
Standard error	SEALPHASS
No uncoded taxa (u)	SU
Percentage of uncoded indivs	PNU
No indivs of grain pests (g)	NG
Percentage of indivs of grain pests	PNG