

**Insect remains from a Roman well at 'Salisweg', Hanau,
Hessen, Germany**

by Harry Kenward and Frances Large

Summary

A series of samples from the fills of a Roman well at 'Salisweg', Hanau, Hessen, Germany, have been analysed for insect remains. The material had been processed using 0.5 mm-mesh sieves and consequently large insects, mainly the larger beetles, predominated.

None of the recovered assemblages were very large, although in one case substantial numbers of ground beetles were present, the well presumably having functioned as a 'pitfall trap'. The surroundings were dominated by artificial habitats, but there was little evidence of nearby vegetation or filth. Several stored-products beetles were identified, but there was no reason to suspect that grain was stored nearby.

If treated conventionally, the samples would almost certainly have provided interpretatively-useful assemblages which would probably have contributed substantially to reconstructing environment and human activity in the surroundings.

Keywords: 'SALISWEG'; HESSEN; GERMANY; ROMAN; WELL; INSECTS; BEETLES; BUGS; ENVIRONMENT; STORED PRODUCTS

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Introduction

This report deals with insect remains from a series of 15 samples from the fills of a well in the *vicus* of the Roman fort at Salisweg, Hanau, Germany. The fills gave preservation of biological remains, including insects, by anoxic waterlogging. The study was carried out at the instigation of Dr Angela Kreuz of the Institut der Kommission für Archäologische Landesforschung in Hessen.

Methods

Practical methods: The samples had been sieved to produce separate 500 µm and 1 mm fractions before transport to England. Insect remains were identified by comparison with material in the collections at the EAU, and by reference to the standard works on European Coleoptera and Hemiptera. An elaterid (click beetle) larva was identified with reference to Dolin (1978).

No attempt was made to identify every fragment, especially of the less frequent taxa; the objective was to obtain archaeological information, not to compile a catalogue of species for biogeographical or climatological purposes. Instead, the more abundant taxa, and those considered likely to give the most information, were targeted for close identification.

Interpretative methods: Interpretation was considerably limited by the small numbers of remains and the method used to extract them, but as far as was possible methods followed those outlined by Kenward (1976),

subsequently modified and developed to a great extent by, for example, Kenward (1988), Hall and Kenward (1990) and Kenward and Hall (1995). The information from direct inspection of the list of species, their abundance, and documented ecology, is simplified using a series of parameters designed to characterise major ecological groups.

Results

The list of invertebrate species recovered from the well is presented in Table 1. Table 2 provides sample-by-sample lists, in which the various fractions and subsamples are listed separately. For technical reasons associated with the database system used for data input and retrieval, nomenclature follows Kloet and Hincks (1964-1977) for the Hemiptera and Coleoptera respectively, with interpolation of non-British taxa, for which Wagner (1966-7) and Freude *et al.* (1964-83) are followed. The nomenclature of Wagner and Freude *et al.* has been added to British species where differing from Kloet and Hincks to assist workers familiar with their systems. Lucht (1987), the current checklist for Central Europe, was unfortunately not available to the authors. The ecological codes assigned to species are explained in Table 3.

'Main statistics' for the assemblage of adult beetles and bugs (using the groups listed in Table 3) cannot appropriately be presented for this material, limiting its interpretative value.

The material is discussed layer-by layer below; sample numbers have been assigned in the EAU for recording purposes.

111-31 (B) (Sample 1010)

This 1 mm fraction contained a few ground beetles (including the strongly synanthropic *Laemostenus terricola* and some others often found in association with human habitations), large staphylinids (one being the maggot-feeding *Creophilus maxillosus*), and the very synanthropic *Tenebroides mauritanicus* and *Blaps* sp.

111-31 (D) (part 1 of 4) (Sample 1011)

Sample 1011 (1 mm fraction) yielded a modest range of beetles, all medium-sized or large. Strong synanthropes (species associated with artificial habitats) included the storage pests *Tenebroides mauritanicus*, *Tenebrio obscurus* and *Alphitobius diaperinus*. There were also ground beetles and some species associated with rotting matter, all common around dwellings.

111-31 (D) (part 3 of 4) (Sample 1012)

Sample 1012 represented the 1.0 mm fraction. Over 20 insect taxa, mainly beetles, were present; all were large or moderately large. Species normally found inside buildings included the grain weevil *Sitophilus granarius*, the ground beetle *Laemostenus terricola* and the storage pest *Alphitobius diaperinus*. The remaining species were predominantly ground beetles often found in areas disturbed by human activity.

111-27 (4) (Samples 1022 and 1023)

The 0.5 mm fraction (Sample 1022) gave only a single ground beetle and an ant, while the 1 mm fraction (Sample 1024) contained only a scrap of cuticle, perhaps a ground beetle.

110-65 (11) (Samples 1005, 1006, 1007 and 1008)

Sample 1006 (part 2 of 4, 0.5 mm fraction) included remains of some rather small species, almost all as single individuals. Decaying matter and open ground with some vegetation were represented, but of course the location of these habitats must remain uncertain since this may have been 'background fauna' (*sensu* Kenward 1976; 1978) which arrived in flight. *Ptinus ?fur* (two individuals) and *Oryzaephilus* sp. probably originated in a building.

Sample 1007 (part 3 of 4, 1 mm fraction) gave a selection of mainly large species, including ground beetles and others favoured by artificial environments.

Sample 1008 (part 4 of 4) represented the 1 mm fraction. Over beetle 20 taxa and a ground bug were identified, all medium-sized or large. Species strongly associated with buildings included *Ptinus fur* and *?Tenebroides mauritanicus*. There were several ground beetles, all likely to be found in disturbed areas around buildings. Some species associated with foul matter were present, but may have originated at some distance. A notable record was of a left hind trochanter, a right mid femur and a right elytral apex of the large scarabaeid beetle *Oryctes nasicornis*, which ranks amongst the largest European beetles. There were a few weevils and an elaterid larva, suggesting that there was some vegetation not too far away.

110-65 (10) (Samples 1005 and 1009)

The 0.5 mm fraction (Sample 1009) gave about 20 beetle taxa, mostly of medium to large size. These were all species often recorded from deposits at archaeological occupation sites, and indicated bare or sparsely-vegetated ground and some foul

matter. One species, *Ptilinus pectinicornis*, is associated with fairly solid dead wood, including structural timber.

Sample **1005** was the 1.0 mm fraction. There were over 20 taxa, principally large or of medium size. Much the most abundant was the synanthropic ground beetle *Pterostichus melanarius* (23 individuals), but there were also four *Patrobis ?atorufus* and five *Pterostichus (Poecilus) sp.*, and smaller numbers of some other ground beetles including the very large *Broscus cephalotes*, *Carabus nemoralis* and *C. monilis*. These surely represent remains which fell into the well accidentally ('pitfall effect'). There were a few species associated with decaying matter, including nine individuals of the eurytopic dung beetle *Aphodius granarius* (able to exploit rotting matter of various kinds in addition to dung). These remains suggest a human-dominated area. There was a single grain weevil, *Sitophilus granarius*.

107-53C (Samples 1003 and 1021)

This, the 0.5 mm fraction (Sample **1021**), produced only two beetles, of no interpretative value. Sample **1003**, representing the 1.0 mm fraction, produced little more: two dung beetles (*Geotrupes sp.* and *Onthophagus sp.*, and a ground beetle frequently associated with occupation sites (*Pterostichus melanarius*).

107-53D (Samples 1002, 1004 and 1021)

Sample **1002** represented a small part of the 0.5 mm fraction. Insect fragments were rather numerous, and it seems likely that a sample treated conventionally by paraffin (kerosene) floatation (as described by Kenward *et al.* 1980) would have produced a very useful assemblage. Over 30 beetle and bug taxa were present, including some fairly small species. The fauna suggested that decaying matter was

present, but an area of disturbed ground with scattered low plants probably contributed many of the species. Two generically-identified taxa, *Cyphon sp.* (three individuals) and *Lesteva sp.* (one), suggest water margins or damp ground; the former is typically associated with wetland vegetation, the latter with stones or mud by water.

Sample **1005** was material from part of the 1.0 mm fraction. The remains were mainly from medium-sized to large ground and dung beetles, with a few species suggesting vegetated areas.

104-26 (5) (Sample 1023)

The 0.5 mm fraction included only scraps of cuticle.

Discussion

Insect, mainly adult beetle and bug, remains were present in moderate numbers in some of the groups of remains provided. Preservation was generally rather good.

The bias caused by the mesh size used has clearly affected the range of remains recovered. The 1 mm and 0.5 mm fractions from the same layer produced quite different assemblages in most cases, and there is a general rarity of smaller species by comparison with archaeological material from a range of other sites. This doubtless reflects the greater range of remains retained by the 0.3 mm sieves normally used for recovery of insect remains. The small number of remains of certain beetles, particularly Ptiliidae, small Staphylinidae, and perhaps Lathridiidae and Cryptophagidae, may result from the use of a large mesh size, for example. It is possible that these obscure but archaeologically important remains were overlooked during sorting, however (this is not uncommon, especially

where sorting is primarily aimed at recovering other material).

Another cause of bias towards large size (but certainly not the whole explanation) is that the remains in at least some cases must represent insect which have fallen into the cut by accident, i.e. 'pitfalls'. This seems to be a likely source of abundant remains in wells which are not completely walled, and it has been observed in the case of a modern well in southern England (Kenward, unpublished).

Despite these reservations, some reconstruction of the surroundings of the well can be made. Together, the recorded remains suggest an area dominated by human activity. The ground was probably largely bare, with some trample-resistant plants, and there was perhaps some litter and dung not far away. However, species associated with such short-lived habitats are often highly migratory and, so may have been common in the local 'background fauna' of flying insects which accidentally fell into deposits as they formed. Deep cut features are particularly likely to trap such remains. It is unlikely that decaying matter was abundant nearby (there was no evidence for stable manure, for example). Equally, although a few grain pests were recorded, there was no evidence for large quantities of spoiling grain, or for material swept from houses. There is no reason to suppose that the fill examined included dumped refuse such as stable manure or domestic waste. This is in marked contrast to two Roman wells in York (Hall *et al.* 1980; Kenward *et al.* 1986). Similarly, the remains were probably not dumped in surface soil

The record of some parts of the large scarabaeid beetle *Oryctes nasicornis* is notable, at least for its novelty value.

Had these deposits been sampled for insect (and other invertebrate) analyses using

standard methods it appears likely that they would have produced abundant and well-preserved remains which would have been of considerable value in interpreting local conditions.

This study has been limited by the method used to recover the insect remains, which will inevitably have resulted in the loss of species which would be important in interpretation. Insects have been recorded from other Roman sites in Germany by several workers (e.g. Friedrich 1987; Koch 1970; 1971; Lemdahl 1990; Schimitscheck 1975), but these studies, like the present one, have been on a relatively restricted scale. If vertical sequences of samples are analysed in detail, as was possible for example for the Roman well at Skeldergate, York, England (Hall *et al.* 1980), a great deal of information may be obtained. Similarly, for sites with more widespread preservation by anoxic waterlogging, an immense amount of information can be recovered by analysis of large numbers of samples, especially when results of botanical and entomological studies are closely integrated (as was done for hundreds of samples from Roman Tanner Row and Anglo-Scandinavian Coppergate, York: Hall and Kenward 1990; Kenward and Hall 1995). It is to be hoped that investigations of waterlogged deposits at occupation sites will eventually be possible on a large scale wherever they occur throughout Europe. Apart from the information gained about the individual sites, a comparative study would doubtless produce many fascinating and archaeologically significant results.

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Table 1. Complete list of invertebrate taxa from 'Salisweg', Hanau, Hessen, with the ecological codes assigned to them. Order and nomenclature follow Kloet and Hincks (1964-77). Where both secure and tentative identifications for a given taxon were recorded, only the former are listed here. For explanation of ecological codes see Table 3.

DIPLOPODA		<i>Agonum dorsale</i> (Pontoppidan)	oa
*Diplopoda sp.	u	[<i>Platynus dorsalis</i>]	
		<i>Agonum</i> sp.	oa
DERMAPTERA		<i>Amara</i> spp.	oa
* <i>Forficula auricularia</i> Linnaeus	rt	<i>Harpalus rufipes</i> (Degeer)	oa
		<i>Harpalus</i> sp.	oa
HEMIPTERA		<i>Badister</i> sp.	oa
? <i>Stygnocoris</i> sp.	oa	Carabidae sp.	ob
Lygaeidae sp.	oa-p	*Carabidae sp. indet. (larva)	ob
<i>Dictynota tricornis</i> (Schrank)	oa-p	<i>Coelostoma orbiculare</i> (Fabricius)	oa-w
Miridae sp.	oa-p	<i>Cercyon analis</i> (Paykull)	rt-sf
Auchenorrhyncha spp.	oa-p	<i>Cercyon</i> spp.	u
		<i>Megasternum obscurum</i> (Marsham)	rt
LEPIDOPTERA		[<i>boletophagum</i>]	
*Lepidoptera sp. (pupa)	u	<i>Cryptopleurum minutum</i> (Fabricius)	rf-st
		<i>Hydraena testacea</i> Curtis	oa-w
DIPTERA		<i>Choleva</i> sp.	u
*Diptera sp. (puparium)	u	<i>Catops</i> sp.	u
*Diptera sp. (adult)	u	<i>Silpha atrata</i> Linnaeus	u
		[<i>Phosphuga</i>]	
HYMENOPTERA		Silphidae sp.	u
*Hymenoptera Parasitica sp.	u	<i>Lesteva</i> sp.	oa-d
*Formicidae sp.	u	<i>Coprophilus striatulus</i> (Fabricius)	rt-st
		<i>Anotylus rugosus</i> (Fabricius)	rt
COLEOPTERA		[<i>Oxytelus</i>]	
<i>Broscus cephalotes</i> Linnaeus	u	<i>Stenus</i> sp.	u
<i>Panagaeus cruxmajor</i> Linnaeus	oa	<i>Rugilus</i> sp.	rt
[<i>crux-major</i>]		[<i>Stilicus</i>]	
<i>Carabus monilis</i> Fabricius	oa	<i>Othius</i> sp.	rt
<i>Carabus nemoralis</i> Muller	oa	<i>Gyrophynus angustatus</i> Stephens	rt-st
<i>Carabus</i> sp.	oa	<i>Gyrophynus fracticornis</i> (Muller)	rt-st
<i>Notiophilus</i> sp.	oa	<i>Philonthus</i> spp.	u
<i>Leistus</i> sp.	oa	<i>Staphylinus</i> sp.	u
<i>Clivina ?collaris</i> (Herbst)	oa	<i>Creophilus maxillosus</i> (Linnaeus)	rt
<i>Clivina fossor</i> (Linnaeus)	oa	<i>Quedius</i> sp.	u
<i>Patrobus ?atorrufus</i> (Strom)	oa	Staphylininae sp.	u
<i>Trechus ?quadristriatus</i> (Schrank)	oa	<i>Cilea silphoides</i> (Linnaeus)	rt-st
<i>Trechus obtusus</i> or <i>quadristriatus</i>	oa	[<i>Leucoparyphus</i>]	
<i>Trechus ?micros</i> (Herbst)	u	Aleocharinae sp.	u
[<i>Trechoblemus</i>]		<i>Trox scaber</i> (Linnaeus)	rt-sf
<i>Trechus</i> spp. indet.	ob	<i>Geotrupes</i> sp.	oa-rf
<i>Asaphidion flavipes</i> (Linnaeus)	oa	<i>Aphodius granarius</i> (Linnaeus)	ob-rf
<i>Bembidion lampros</i> (Herbst)	oa	<i>Aphodius</i> spp.	ob-rf
<i>Bembidion ?properans</i> Stephens	oa	<i>Oxyomus sylvestris</i> (Scopoli)	rt-sf
<i>Bembidion</i> sp.	oa	<i>Onthophagus</i> sp.	oa-rf
<i>Tachys</i> sp.	oa	<i>Oryctes nasicornis</i> (Linnaeus)	u
<i>Pterostichus melanarius</i> (Illiger)	ob	<i>Cyphon</i> sp.	oa-d
<i>Pterostichus (Poecilus)</i> sp.		<i>Melanotus ?erythropus</i> (Gmelin)	l
[<i>Poecilus</i>]	oa	[<i>rufipes</i>]	
<i>Pterostichus</i> sp.	ob	* <i>elanotus ?erythropus</i> (Gmelin) (larva)	l
<i>Calathus fuscipes</i> (Goeze)	oa	[<i>rufipes</i>]	
<i>Laemostenus terricola</i> (Herbst)	ss	*Elateridae sp. (larva)	u
[<i>Pristonychus</i>]		<i>Ptilinus pectinicornis</i> (Linnaeus)	l

<i>Ptinus fur</i> (Linnaeus)	rd-sf
<i>Ptinus</i> sp. indet.	rd-sf
<i>Tenebroides mauritanicus</i> (Linnaeus)	rt-ss
<i>Eपुरaea</i> sp.	u
<i>Oryzaeophilus</i> sp.	g-ss
<i>Atomaria</i> sp.	rd
<i>Corticaria</i> sp.	rt-sf
<i>Blaps</i> sp.	rt-ss
<i>Alphitobius diaperinus</i> (Panzer)	rt-ss
<i>Tenebrio obscurus</i> Fabricius	rt-ss
<i>Gastrophysa viridula</i> (Degeer)	oa-p
[<i>Gastroidea</i>]	
<i>Phyllotreta</i> sp.	oa-p
<i>Altica</i> sp.	oa-p
[<i>Haltica</i>]	
<i>Crepidodera</i> sp.	oa-p
<i>Chaetocnema arida</i> group	oa-p
Halticinae sp.	oa-p
<i>Apion</i> sp.	oa-p
<i>Sitona</i> sp.	oa-p
<i>Cleonus piger</i> (Scopoli)	oa-p
[<i>Cleonis</i>]	
<i>Sitophilus granarius</i> (Linnaeus)	g-ss
Ceuthorhynchinae sp.	oa-p
Curculionidae sp.	oa
Coleoptera sp.	u
ARACHNIDA	
*Acarina sp.	u
*Aranae sp.	u

Table 2. Species lists in rank order for invertebrate macrofossils from samples from 'Salisweg', Hanau, Hessen. The adult Hemiptera (bugs) and Coleoptera (beetles) are listed first, followed by the remaining invertebrates. Weight is in kilogrammes, ec = ecological code; n = minimum number of individuals; sq = semi-quantitative (e = estimate; - = fully quantitative, m = 'many', translated as 15 individuals; s = several, translated as 6). For translation of ecological codes, see Table 3. To enable entry to the computer database, the depth is entered in the field 'CA' followed by any other codes (e.g. 111-31 (B) = 111-31B).

Context: 0 Sample: 1002 CA: 107-53D ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 0.5 mm fraction

Cyphon sp.	3	n	oa-d
Megasternum obscurum	2	n	rt
Crepidodera sp.	2	n	oa-p
Dictynota tricornis	1	n	oa-p
?Stygnocoris sp.	1	n	oa
Miridae sp.	1	n	oa-p
Auchenorhyncha sp. A	1	n	oa-p
Auchenorhyncha sp. B	1	n	oa-p
Auchenorhyncha sp. C	1	n	oa-p
Auchenorhyncha sp. D	1	n	oa-p
Trechus ?quadristriatus	1	n	oa
Trechus ?micros	1	n	u
Tachys sp.	1	n	oa
Carabidae sp.	1	n	ob
Cercyon analis	1	n	rt-sf
Cryptopleurum minutum	1	n	rf-st
Hydraena testacea	1	n	oa-w
Catops sp.	1	n	u
Silpha atrata	1	n	u
Lesteva sp.	1	n	oa-d
Anotylus rugosus	1	n	rt
Gyrohypnus angustatus	1	n	rt-st
Philonthus sp.	1	n	u
Quedius sp.	1	n	u
Cilea silphoides	1	n	rt-st
Aleocharinae sp.	1	n	u
Aphodius ?granarius	1	n	ob-rf
Oxyomus sylvestris	1	n	rt-sf
Epuraea sp.	1	n	u
Corticaria sp.	1	n	rt-sf
Chaetocnema arida group	1	n	oa-p
Halticinae sp.	1	n	oa-p
Apion sp.	1	n	oa-p
Rugilus sp.		n	rt
*Acarina sp.	1	n	u
*Aranae sp.	1	n	u
*Formicidae sp.	1	n	u
*Hymenoptera Parasitica sp.	1	n	u

Context: 0 Sample: 1003 CA: 107-53C ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 1.0 mm fraction

Pterostichus melanarius	1	n	ob
Geotrupes sp.	1	n	oa-rf

Onthophagus sp. 1 n oa-rf

Context: 0 Sample: 1004 CA: 107-53D ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 1.0 mm fraction

Catops sp.	3	n	u
Auchenorhyncha sp.	1	n	oa-p
Panagaeus cruxmajor	1	n	oa
Carabus sp.	1	n	oa
Clivina ?fossor	1	n	oa
Trechus ?quadristriatus	1	n	oa
Bembidion ?properans	1	n	oa
Pterostichus melanarius	1	n	ob
Calathus fuscipes	1	n	oa
Megasternum obscurum	1	n	rt
Silphidae sp.	1	n	u
Geotrupes sp.	1	n	oa-rf
Onthophagus sp.	1	n	oa-rf
Cyphon sp.	1	n	oa-d
Melanotus ?erythropus	1	n	l
Altica sp.	1	n	oa-p
*Diptera sp. (puparium)	2	n	u

Context: 0 Sample: 1005 CA: 110-65(11) ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 1.0 mm fraction

Pterostichus melanarius	23	n	ob
Aphodius granarius	9	n	ob-rf
Pterostichus (Poecilus) sp.	6	n	oa
Patrobus ?atorrufus	4	n	oa
Staphylinus sp.	3	n	u
Agonum sp.	2	n	oa
Catops sp.	2	n	u
Broscus cephalotes	1	n	u
Carabus monilis	1	n	oa
Carabus nemoralis	1	n	oa
Notiophilus sp.	1	n	oa
Clivina fossor	1	n	oa
Asaphidion flavipes	1	n	oa
Pterostichus sp.	1	n	ob
Calathus fuscipes	1	n	oa
Amara sp.	1	n	oa
Coelostoma orbiculare	1	n	oa-w
Silphidae sp.	1	n	u
Philonthus sp. A	1	n	u
Philonthus sp. B	1	n	u

Trox scaber 1 n rt-sf
 Aphodius sp. A 1 n ob-rf
 Melanotus erythropus 1 n l
 Ptinus sp. 1 n rd-sf
 Sitophilus granarius 1 n g-ss

Context: 0 Sample: 1006 CA: 110-65(11) ReM: S
 Weight: 0.00 E: 0.00 F: 0.00

Notes: Part 2 of 4, 0.5 mm fraction

Megasternum obscurum 2 n rt
 Ptinus fur 2 n rd-sf
 Auchenorhyncha sp. 1 n oa-p
 Clivina fossor 1 n oa
 Trechus quadristriatus 1 n oa
 Asaphidion flavipes 1 n oa
 Bembidion lampros 1 n oa
 Pterostichus sp. 1 n ob
 Harpalus sp. 1 n oa
 Catops sp. 1 n u
 Stenus sp. 1 n u
 Gyrohypnus angustatus 1 n rt-st
 Aphodius granarius 1 n ob-rf
 Aphodius sp. 1 n ob-rf
 Oryzaephilus sp. 1 n g-ss
 Atomaria sp. 1 n rd
 Phyllotreta sp. 1 n oa-p
 *Carabidae sp. (larva) 1 n ob
 *Diplopoda sp. 1 n u
 *Formicidae sp. 1 n u
 *Hymenoptera Parasitica sp. 1 n u

Context: 0 Sample: 1007 CA: 110-65(11) ReM: S
 Weight: 0.00 E: 0.00 F: 0.00

Notes: Part 3 of 4, 1.0 mm fraction

Aphodius granarius 2 n ob-rf
 Carabus sp. 1 n oa
 Patrobus atrorufus 1 n oa
 Trechus quadristriatus 1 n oa
 Pterostichus melanarius 1 n ob
 Pterostichus sp. 1 n ob
 Agonum sp. 1 n oa
 Harpalus sp. 1 n oa
 Catops sp. 1 n u
 Silpha atrata 1 n u
 Staphylinus sp. 1 n u
 Geotrupes sp. 1 n oa-rf
 Aphodius sp. A 1 n ob-rf
 Aphodius sp. B 1 n ob-rf
 Gastrophysa viridula 1 n oa-p
 Sitona sp. 1 n oa-p
 Cleonus piger 1 n oa-p
 Curculionidae sp. 1 n oa
 Pterostichus (Poecilus) sp. n oa

Context: 0 Sample: 1008 CA: 110-65(11) ReM: S
 Weight: 0.00 E: 0.00 F: 0.00

Notes: Part 4 of 4, 1.0 mm fraction

Pterostichus melanarius 2 n ob
 Lygaeidae sp. 1 n oa-p
 Carabus sp. 1 n oa
 Patrobus atrorufus 1 n oa
 Trechus obtusus or quadristriatus 1 n oa
 Calathus sp. 1 n oa
 Agonum sp. 1 n oa
 Amara sp. A 1 n oa
 Amara sp. B 1 n oa
 Carabidae sp. 1 n ob
 Catops sp. 1 n u
 Silpha atrata 1 n u
 Philonthus sp. 1 n u
 Staphylinus sp. 1 n u
 Geotrupes sp. 1 n oa-rf
 Aphodius granarius 1 n ob-rf
 Aphodius sp. 1 n ob-rf
 Oryctes nasicornis 1 n u
 Ptinus fur 1 n rd-sf
 Sitona sp. 1 n oa-p
 Curculionidae sp. 1 n oa
 Coleoptera sp. 1 n u
 *Elateridae sp. (larva) 1 n ob

Context: 0 Sample: 1009 CA: 110-65(10) ReM: S
 Weight: 0.00 E: 0.00 F: 0.00

Notes: part 4 of 4, 0.5 mm fraction

Gyrohypnus fracticornis 2 n rt-st
 Clivina collaris 1 n oa
 Trechus sp. A 1 n ob
 Trechus sp. B 1 n ob
 Bembidion lampros 1 n oa
 Bembidion sp. 1 n oa
 Carabidae sp. A 1 n ob
 Carabidae sp. B 1 n ob
 Carabidae sp. C 1 n ob
 Cercyon sp. A 1 n u
 Cercyon sp. B 1 n u
 Choleva sp. 1 n u
 Catops sp. 1 n u
 Coprophilus striatulus 1 n rt-st
 Stenus sp. 1 n u
 Othius sp. 1 n rt
 Aphodius sp. A 1 n ob-rf
 Aphodius sp. B 1 n ob-rf
 Oxyomus sylvestris 1 n rt-sf
 Ptilinus pectinicornis 1 n l-sf

Context: 0 Sample: 1010 CA: 111-31B ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: ORG 1

Pterostichus melanarius	4	n	ob
Trechus ?quadristriatus	2	n	oa
Staphylinus sp.	2	n	u
Clivina fossor	1	n	oa
Laemostenus terricola	1	n	ss
Harpalus ?rufipes	1	n	oa
Badister sp.	1	n	oa
Creophilus maxillosus	1	n	rt
Tenebroides mauritanicus	1	n	rt-ss
Blaps sp.	1	n	rt-ss

Context: 0 Sample: 1011 CA: 111-31D ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: Part 1 of 4, 1.0 mm fraction

Tenebrio obscurus	3	n	rt-ss
Alphitobius diaperinus	2	n	rt-ss
Clivina fossor	1	n	oa
Trechus sp.	1	n	ob
Pterostichus melanarius	1	n	ob
Calathus fuscipes	1	n	oa
Harpalus sp.	1	n	oa
Carabidae sp.	1	n	ob
Catops sp.	1	n	u
Philonthus sp.	1	n	u
Staphylinus sp. A	1	n	u
Staphylinus sp. B	1	n	u
Quedius sp.	1	n	u
Tenebroides mauritanicus	1	n	rt-ss
Blaps sp.	1	n	rt-ss
Curculionidae sp.	1	n	oa
*Melanotus erythropus (larva)	1	n	l
*Diptera sp. (adult)	1	n	u
*Lepidoptera sp. (pupa)	1	n	u

Context: 0 Sample: 1012 CA: 111-31D1 ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 1.0 mm fraction

Catops sp.	3	n	u
Alphitobius diaperinus	2	n	rt-ss
Lygaeidae sp.	1	n	oa-p
Patrobus ?atorufus	1	n	oa
Trechus sp.	1	n	ob
Pterostichus ?melanarius	1	n	ob
Calathus fuscipes	1	n	oa
Laemostenus terricola	1	n	ss
Agonum dorsale	1	n	oa
Harpalus rufipes	1	n	oa
Harpalus sp.	1	n	oa
Philonthus sp.	1	n	u
Quedius sp.	1	n	u

Staphylininae sp.	1	n	u
Trox scaber	1	n	rt-sf
Aphodius ?granarius	1	n	ob-rf
Tenebrio obscurus	1	n	rt-ss
Altica sp.	1	n	oa-p
Sitophilus granarius	1	n	g-ss
*Diptera sp. (adult)	1	n	u
*Forficula auricularia	1	n	rt
*Diptera sp. (puparium)	1	n	u

Context: 0 Sample: 1021 CA: 107-53C ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 0.5 mm fraction

Ceuthorhynchinae sp.	1	n	oa-p
Curculionidae sp.	1	n	oa

Context: 0 Sample: 1022 CA: 111-27(4) ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 0.5 mm fraction

Leistus sp.	1	n	oa
*Formicidae sp.	1	n	u

Context: 0 Sample: 1023 CA: 104-26(5) ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: Part 1 of 2, 0.5 mm fraction

*Insecta sp.	1	n	u
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Context: 0 Sample: 1024 CA: 111-27(4) ReM: S
Weight: 0.00 E: 0.00 F: 0.00

Notes: 1.0 mm fraction

Carabidae sp.	1	n	ob
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Table 4. Abbreviations for ecological codes (lower case codes in parentheses) used in Tables 1-2. The group codes (in capitals) have not been calculated for the present site. See Table 1 for codes assigned to taxa from 'Salisweg'. Indivs - individuals (based on MNI); No - number.

No taxa	S	Percentage of RT taxa	PSRT
Estimated number of indivs (MNI)	N	No RT indivs	NRT
Index of diversity (α)	alpha	Percentage of RT indivs	PNRT
Standard error of alpha	SE alpha	Index of diversity of RT component	alpha RT
No 'certain' outdoor taxa (oa)	SOA	Standard error	SEalphaRT
Percentage of 'certain' outdoor taxa	PSOA	No 'dry' decomposer taxa (rd)	SRD Percentage of RD
No 'certain' outdoor indivs	NOA	taxa	PSRD
Percentage of 'certain' outdoor indivs	PNOA	No RD indivs	NRD
No OA and probable outdoor taxa (oa+ob)	SOB	Percentage of RD indivs	PNRD
Percentage of OB taxa	PSOB	Index of diversity of the RD component	alphaRD
No OB indivs	NOB	Standard error	SEalphaRD
Percentage OB indivs	PNOB	No 'foul' decomposer taxa (rf)	SRF
Index of diversity of the OB component	alphaOB	Percentage of RF taxa	PSRF
Standard error	SEalphaOB	No RF indivs	NRF
No aquatic taxa (w)	SW	Percentage of RF indivs	PNRF
Percentage of aquatic taxa	PSW	Index of diversity of the RF component	alphaRF
No aquatic indivs	NW	Standard error	SEalphaRF
Percentage of W indivs	PNW	No synanthropic taxa (sf+st_ss)	SSA
Index of diversity of the W component	alphaW	Percentage of synanthropic taxa	PSSA
Standard error	SEalphaW	No synanthropic indivs	NSA
No damp ground/waterside taxa (d)	SD	Percentage of SA indivs	PNSA
Percentage D taxa	PSD	Index of diversity of SA component	ALPHASA
No damp D indivs	ND	Standard error	SEALPHASA
Percentage of D indivs	PND	No facultatively synanthropic taxa	SSF
Index of diversity of the D component	alphaD	Percentage of SF taxa	PSSF
Standard error	SEalphaD	No SF indivs	NSF
No strongly plant-associated taxa (p)	SP	Percentage of SF indivs	PNSF
Percentage of P taxa	PSP	Index of diversity of SF component	ALPHASF
No strongly P indivs	NP	Standard error	SEALPHASF
Percentage of P indivs	PNP	No typical synanthropic taxa	SST
Index of diversity of the P component	alphaP	Percentage of ST taxa	PSST
Standard error	SEalphaP	No ST indivs	NST
No heathland/moorland taxa (m)	SM	Percentage of ST indivs	PNST
Percentage of M taxa	PSM	Index of diversity of ST component	ALPHAST
No M indivs	NM	Standard error	SEALPHAST
Percentage of M indivs	PNM	No strongly synanthropic taxa	SSS
Index of diversity of the M component	alphaM	Percentage of SS taxa	PSSS
Standard error	SEalphaM	No SS indivs	NSS
No wood-associated taxa (l)	SL	Percentage of SS indivs	PNSS
Percentage of L taxa	PSL	Index of diversity of SS component	ALPHASS
No L indivs	NL	Standard error	SEALPHASS
Percentage of L indivs	PNL	No uncoded taxa (u)	SU
Index of diversity of the L component	alphaL	Percentage of uncoded indivs	PNU
Standard error	SEalphaL	No indivs of grain pests (g)	NG
No decomposer taxa (rt + rd + rf)	SRT	Percentage of indivs of grain pests	PNG