# Turf roofs and urban archaeological build-up

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## Abstract

Studies of sods used to line the thatched roof of an old farm-building in north-west England showed that turves might have been a major source of mineral particles and plant and insect remains in some archaeological deposits. Conversely, it might be possible to recognize the remains of turf roofs on occupation sites from characteristic elements of the biota. Analysis of a sample of the accumulation on the floor of the building prompts reconsideration of the nature of 'indoor' and 'outdoor' medieval insect assemblages.

## Key words

TURF ROOFS, MODERN PARALLELS, PLANT REMAINS, INSECTS, SEDIMENTS, DEATH ASSEMBLAGES, HEATHLAND BIOTA, BUILDINGS, URBAN OCCUPATION BUILD-UP, PARASITE OVA

## Introduction

During preparation of a report dealing with the biota of massive waterlogged build-up at two Anglo-Scandinavian sites in York (Hall *et al.* forthcoming), ARH and HKK constructed theoretical models to account for the plant, animal and mineral contents of such deposits according to depositional circumstances. As one result, the potential importance of roofing materials was recognized, and turf roofing was regarded as especially likely to contribute a wide range of organisms.

At the same time an opportunity arose to study the straw-and-turf roof on a standing building in Nw England. It was brought to the authors' attention by William Tegetmeier, employed to restore the roof of a small barn attached to a cottage at Pow Bank, between Durdar and Buckabank, 5 km S of Carlisle, Cumbria (Grid Reference NY 385499). The group of buildings stand at an altitude of about 60 m OD, in an area of hayfields and pasture land, with hedgerows and many large trees growing singly or in small groups. The building was visited on 1st July 1980.

The roof consisted of old, decaying straw thatch laid over turves; these in turn were set on rough timber rafters and purlins. Some of the timbers were unsplit trunks and some still bore bark. The turf *in situ* in the roof was dry and carried the remains of plants cut with it. The turves seemed originally to have been laid as rectangles about 50 by 30 cm and were about 1.5-5 cm in thickness. When the authors visited the site, the roof had largely been stripped. Much of the straw, together with some of the turves, had been heaped as waste in a nearby garden, and had stood for a few weeks. The better-preserved turves had been stacked in a corner of the barn for re-use. The date at which the turves were originally cut and placed on the roof is uncertain, possibly early in the twentieth century; their actual age is, however, largely immaterial to the present argument.

For this study, biological analyses were made of dry turves from the heap in the barn, of straw and turves from the heap in the garden, and of soil from the barn floor. This paper is intended to deal with principles not details; for this reason, no detailed soil analyses have been made, plant remains are listed semi-quantitatively, and insect identifications have not been pressed unless crucial for ecological categorization.

## Practical Methods

Methods of extraction followed those of Kenward *et al.* (1980). The problems of dealing with modern samples discussed in that work (p. 13) were particularly acute here since most of the material was extremely dry. As a result, prolonged boiling was needed for successful paraffin flotation. A second problem was caused by the close-knit roots in the turves; patient teasing apart was required prior to sieving to release the insect and plant macrofossils. Even so, some insects remained entangled in the residues, which were consequently sorted in their entirety for most of the samples.

## Results

The material examined is listed in Table 1. The turves varied considerably, some being largely of matted roots holding a little soil, others mostly soil, with only sufficient roots to bind it. Some of the turf had quite clearly been cut from an area of heathland, having abundant heather or ling (*Calluna vulgaris),* together with heathland or moorland mosses, obvious to the naked eye (Table 2). The remainder appeared to have come from close-cropped acid (*Nardus stricta* L.-dominated) grassland.

The plant remains from the samples are listed in Table 2, and the most abundant insects in Table 3. Some important statistics of the insect assemblages are given in Table 4, and a full list of taxa identified, including the ecological categories in which they were placed, is given in the appendix (Table 7). Taxa not listed in Table 3 were recorded at a frequency of no more than two in any sample. Records of insects which were alive when the samples were collected are given in Table 5.

All the samples gave moderately abundant or abundant plant and insect remains. The number of species was remarkably large: about 70 plants and 120 bugs and beetles from the turves. The straw was less rich in species, but the sample of soil from the floor contained 99 species of Coleoptera and Hemiptera and 58 of plants.

The turves analysed for plant remains (samples 1 and 4) yielded a varied flora dominated, at least in terms of vegetative parts, by heathland or moorland species. The list of 'seeds', on the other hand, includes taxa from a variety of additional habitats; these seeds are most likely to have been introduced to the turves whilst in the roof. Thus there are several weeds, such as *Atriplex* sp(p). (oraches), *Polygonum* spp. (knotgrass, black bindweed and pale persicaria), *Stellaria media* (chickweed), *Tripleurospermum maritmum* ssp. *inodorum* (scentless mayweed) and *Urtica dioica* (stinging nettle). These, however, generally occur at very low frequencies. There is also a component indicative of poorly-drained soils or wetland habitats: *Isolepis setacea* (bristle scirpus), *Juncus bufonius* (toad rush), and perhaps some of the mosses and *Carex* spp. (sedges). Some or all of these taxa may have grown in the area cut for turf. leaves of *Taxus baccata* (yew) almost certainly arrived on the turves after they had been taken from the roof.

The insect lists from samples 1-3, from turves heaped in the garden, are dominated by a mixture of (a) species which appear likely to have been imported in turf (Table 6); (b) species likely to have bred in thatch and turf on the roof, or in the short period after stripping, for example *Mycetaea hirta* and Corticariinae; (c) species associated with timber, for example *Anobium punctatum*; and (d) eurytopic species which are plausible components of the first two groups. The rarer species in the main could belong to these four groups, but some are probably 'background fauna' (Kenward 1975, 88), including fragmentary remains of Curculionidae and Carabidae which almost certainly originated in bird-droppings. A particularly characteristic example was a pronotum of *Hypera punctata* into which many fragments of a variety of other insects were crammed, exactly matching material seen in bird-droppings (Kenward 1976). Bird droppings containing insects in a similar condition have been identified from archaeological deposits (Girling 1977).

Interpretation of urban archaeological insect death assemblages relies on the examination of a series of properties of whole assemblages (Kenward, 1978). These are listed for the present material in Table 4 and are discussed here in the context of three archaeological sites: 6-8 Pavement, York (Hall *et al.* forthcoming), interpreted as a series of Anglo-Scandinavian construction, occupation and destruction deposits, mainly within the ground-plans of buildings; 5-7 Coppergate, York (ibid.), of similar date, but interpreted as mainly representing deposition in a yard; and 'Sondrefelt', Gamlebyen, Oslo, Norway (Kenward, forthcoming), where the samples mostly came from outdoor cess-pit deposits of 11th-16th century date.

All the turf samples from Pow Bank gave assemblages with quite or very high proportions of 'outdoor' insects (Kenward, 1978, 14), the percentage (certain-plus-probable, OB) ranging from 22 to 51 (mean 42). This compares with means for Pavement and Coppergate of 13% and 27% respectively, and of 20% for Oslo. Diversity (species-richness, ibid., 21; using alpha of Fisher *et al.* 1943), too, is in the middle to high ranges calculated for medieval urban material (mean alpha = 41). The proportion of aquatic insects is much as in other terrestrial deposits, 0-2%. The rotting matter component also falls in the range seen in early medieval material; the proportion of foul-matter species (Rf) is, at a mean of 5%, lower than in the samples from Oslo (mean 16%), and only a little higher than the values seen at the Pavement site (mean 2%).

The turf samples (1-3) all came from essentially similar material and this is reflected in the statistics, except for the great difference in diversity between 1 (alpha = 64) and 2 and 3 (27 and 35 respectively). This difference is significant at the 95% level and not obviously explicable; that the difference in diversity is present in the outdoor component is demonstrated by the combination in sample 1 of a larger number of outdoor species with a smaller number and percentage of outdoor individuals than in samples 2 and 3 (Table 4). The higher value for Rd (species of litter and dry compost) in sample 3 doubtless reflects greater colonization by decomposer species after cutting. Such observations give a hint of the sort of variation to be expected in archaeological material. Clearly, there can be quite large differences between the biota of samples of material of essentially similar origin.

Samples 1-3 also resemble one another in including quite a large proportion of insects certain to have come from moorland habitats (3-8%, mean 5%); if taxa rather characteristic of, but not confined to, such habitats are included the values are 11-33% (mean 19%; Table 6).

The grass turf sample (4) gave a small insect assemblage with the largest proportion of outdoor forms (51%), but this value is not very different from that for sample 1. There is a moderate proportion of moorland types (8%). Only sample 2 gave nearly as low a value for decomposer species (Rt), although little reliance can be placed on derived statistics for so small an assemblage.

On the other hand, the assemblage from the straw-pile sievings, sample 5, is dominated by species likely to have bred in the roof materials (categories (b) and (c) above). It gave the smallest proportion of outdoor insects (still rather high at 22%), diversity in the middle range, a high proportion of rotting-matter species (especially Rd), and no moorland types. The assemblage is, however, too small for confident discussion.

Sample 6, from the barn floor, gave an assemblage of plant remains much like the other samples, but with a slightly greater number of taxa. In addition to the plants noted above, weed taxa included *Plantago major* (great plantain) and *Spergula arvensis* (corn spurrey), and the wetland *Hydrocotyle vulgaris* (marsh pennywort) was also recorded. The insect assemblage is particularly interesting. The proportion of outdoor insects is moderately high at 26%, diversity very high indeed (alpha = 88, SE = 11). There are many species (99), but few of them are at all abundant. The rotting matter component values are close to the mean for urban medieval samples so far examined.

During sorting for plant remains some small rodent faeces were recovered. These were probably from the house mouse (*Mus musculus*) as the droppings were approximately 6 mm long by 2-2.5 mm wide, the dimensions quoted by Bang and Dahlstrom (1974). On microscopic examination, these droppings proved to contain eggs of *Trichuris* or *Capillaria*. Both these genera contain species which are intestinal parasites of rats and mice. The eggs have a mean length and width of 55.7 and 26.0 microns respectively, and distinctly textured shells, which suggests they are not a *Trichuris* but are more likely to be one of the capillariines of house mouse. It is interesting to note that their size is very close to that of *Trichuris trichiura*, the whipworm of man, which is often present in archaeological deposits (see for example Jones, 1982).

## Discussion

That turf was used in building walls and roofs in the past is widely accepted amongst archaeologists; the excavational evidence for turf roofs, however, is modest. A good example from medieval Britain is Mawgan Porth, Cornwall (Bruce-Mitford, 1956), where turves were identified from rectangular soil stains associated with the collapse of Dark Age dwellings. The use of turf for major structures such as banks and walls is, of course, much better attested - for example Robertson *et al.* (1975) recorded 'fresh-looking turf packing a ditch under a room' in the Antonine *principia* of the Roman fort at Bar Hill, Scotland, and Sumpter and Coll (1977) report turf from the ramparts of the Roman defences of York.

Ethnographic evidence for roofing in turf is abundant (for example Evans 1957), and, indeed, the practice continues today in parts of Norway (Melheim, 1953), while Fenton (1978) records the use of turves (called pones) in roofs in Shetland as recently as the 1960s. Geddes (1955) describes the annual renewal of turf roofs in the Outer Hebrides, where fresh turf was laid on light rafters and covered with barley straw - a direct parallel to the roof at Pow Bank. Mercer (1975) mentions 'Improved Long Houses' of late 17th and early 18th century construction from Cumberland, citing 'a now demolished ...[cottage]... at Dalston', retaining its cruck truss, mud walls and turf roof. Dalston is only 1.5 km from Pow Bank and the barn investigated is very likely a survivor of the buildings mentioned by Mercer.

Whilst it seems that turf was normally placed grass-side-up (Billett, 1979) to face the weather, especially where used for ridge and gables to finish a straw thatch. Innocent (1916) mentions charcoal-burners' conical huts in S. Yorkshire in the early years of this century where the sods were placed grass-side-down; he remarks that this is the practice adopted in Sweden too. The orientation of turf, and presence or absence of a lining (typically birch-bark in the Norwegian examples (Melheim, 1953)), would naturally affect the amount of material falling from the roof to the floors inside.

The analyses of the material from this recent roof have clearly shown that imported turf will bring with it a variety of components, mineral and biological, which may be recognized on archaeological sites. These are now considered in more detail:

a) *Mineral deposition*
Although no rigorous analyses have been made here, it is clear from observations of the whole turves that such material would, if used, provide an important source of mineral deposition on occupation sites. Material imported with turves may have found its way into archaeological build-up either when it was released by decay of turves *in situ* (especially where they formed the innermost layer of a roof) or when the roof was stripped or collapsed. Obviously the proportions of clay, silt, sand and stones falling from the roof will vary according to the nature of the soil on which the turf grew. Particle size analysis of material believed to have formed entirely from turves may be worthwhile if comparison can be made with distinctive local soils and the general accumulation on the site. However, if mineral particles from turf are dispersed into the general accumulation of a site, recognition by particle size analysis will be impossible.

Turf roofs may have contributed a large mineral component to the build-up on archaeological sites. A 10 x 10 x 1.5 cm sample from one of the turves contained 85 g of mineral matter (equivalent to 8.5 kg $m^{-2}$; 567 kg $m^{-3}$). Anglo-Scandinavian structures at 6-8 Pavement, York, are believed to have been re-built after only a decade or so (Addyman *et al.*, forthcoming); turf roofs on such short-lived structures would account for a large proportion of the mineral component observed in the massive build-up of early medieval towns. It must be emphasized, however, that there is as yet no definite evidence that turf was used at any urban site in Britain, while there is some evidence for the presence of some other materials - namely hay and straw - suitable for roofing (Hall *et al.*, forthcoming).

b) *Plants and animals*
Clearly, all four 'turf samples included many plants and insects from the cutting area. Indeed, the bulk of the plant remains were vegetative parts of heathland or moorland taxa. Although the number of undoubted moorland insects is modest, these remain as a distinctive component of the fauna. A very similar assemblage, including *Ulopa reticulata* (a froghopper), *Bradycellus ruficollis* (a ground beetle) and *Strophosomus sus* (a weevil), was recovered from a litter sample from *Calluna* heathland turf from Skipwith Common, a few kilometres south of York (GR SE 6537). Urban archaeological assemblages occasionally include elements of this moorland flora and fauna; *Calluna vulgaris*, *Bradycellus ruficollis* and *Strophosomus sus* have been recorded from the Pavement site, York, for example (Hall *et al.*, forthcoming), and *Ulopa reticulata* from the Aldwark site, York (Kenward *et al.* unpublished). However, no assemblages have yet been recovered which resemble those from the Pow Bank turf.

The range of plants and animals imported with the turf will, like the mineral fraction, depend on the area from which the turf had been cut. Poor grassland, heather moor and other marginal land is most likely to have been exploited for turf-cutting. This description, of course, applies to very large areas of the Highland Zone. The turves from Pow Bank, under an outer straw thatch, bore only dead plant material; modern turf roofs in Norway (Melheim 1953 and authors' observations at Oslo Folk Museum), by contrast, carry a diverse living flora. Indeed, the presence of live plants on turf, whether from the original vegetation or colonizing secondarily, is of great importance. (Straw thatch may also be colonized by plants, but only secondarily.) The binding qualities of the living plants assist in the survival of the roof. In the past such plants may have been an important long-lasting source of propagules and vegetative remains around, if not actually within, buildings. Insects may have colonized the plants and lived amongst their roots, and this may indeed have been the most likely source of phytophages on a site where disturbance of vegetation at ground level was intense. Other insects doubtless can exploit decaying matter in turf, and nests of birds and mammals may provide further roof habitats.

Another major component may find its way into roofing materials by accident. Flying insects and wind-blown insects and plant propagules, together with seeds and insects from bird-droppings are likely to be abundant in open-textured organic roofing materials like turf and straw. Once trapped in the interstices of such materials, most insect corpses or seeds are unlikely to be dislodged. The exact nature of this component will naturally depend on the surrounding habitats and it will be difficult to distinguish it from the rarer species imported with turf. when a roof was demolished in the past, turves may have remained on or around the site and further species may have invaded - weeds and decomposer insects. Roofing material carrying soot from open fires is well-known for its manuring properties (see for example Uhlig 1961) with reference to Western Scotland) and dumps of it would favour nitrophile plants such as stinging nettles (*Urtica dioica*).

## The barn floor sample

Sample 6 deserves further discussion for two reasons not directly related to the problem of recognizing turf roof biota. Firstly, the records of *Capillaria* emphasize that a deposit containing eggs superficially resembling those of *Trichuris trichiura*, typically found in man, cannot be assumed to include human faecal material. The eggs must be closely identified, and species living in other animals eliminated, before any conclusion is drawn.

Secondly, the insect assemblage from sample 6 has important implications. A few moorland individuals are present, indicating that corpses may pass from the roof to floor build-up; the proportion (1%) is, however, too small for there to have been any misinterpretation had the assemblage been an archaeological one. On the other hand, the assemblage would certainly have been categorized as 'outdoor' (Kenward, 1978, 14). It appears that deposits formed in buildings may include many outdoor insects. If there are unglazed windows, doors left open for long periods, or open eaves, 'background' fauna may accumulate in considerable amounts. Pressure differences brought about by airflow patterns round and through the building may even enhance deposition of flying insects within it. Bats and insectivorous birds may roost on rafters and deposit faeces, and human beings may import insects, for example in mud on footwear and in raw materials and foodstuffs. This prompts a re-examination of some fossil faunas. The assemblages from the Pavement site include a few with a high percentage of outdoor insects and high diversity. Although on the available archaeological evidence these were believed to have formed within ground plans and perhaps even to represent occupation build-up, they were regarded on entomological evidence as having accumulated in the open, or as incorporating re-deposited yard deposits. It would be rash to re-interpret these as having formed on the floors of incompletely closed buildings on the basis of one sample, but a suspicion remains. Clearly, the investigation of other modern indoor deposits is a high priority.

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*Table 1. Material examined from the Pow Bank roof and barn floor. * - paraffin residue examined for insects. This would not be needed for sample 5, but in the case of the turf samples many moorland insects were trapped among rootlets and did not float. However, sample 3 differs little from 1 and 2 as a result. Key: x - analysis made.*

| Sample | Plants | Insects | Weight (kg) | Nature of material |
|---|---|---|---|---|
| 1* | x | x | 1.0 (moist) | *Calluna*-rich turf from heap |
| 2* | - | x | 1.2 (moist) | Moist *Calluna* turf from heap |
| 3 | - | x | 1.0 (moist) | Moist *Calluna* turf from heap |
| 4* | x | x | 0.5 (dry) | Grassy turf from pile on barn floor |
| 5 | - | x | 0.25 (dry) | Sievings from rotting material, mostly straw, in heap |
| 6* | x | x | 1.0 | 'Soil'accumulation formed on and between sandstone flags of barn floor |

*Table 2. Plant remains from samples 1, 4 and 6.*

The estimates of frequency of seeds are as follows: + - very rare or rare (1-5 seeds); H - occasional (6-20); w - frequent (21-50); ++++ - common (51-200); HH+ - abundant (>200). These are based on counts of individuals for 'seeds' and on a visual assessment of frequency during sorting for other remains. Abbreviations: a - achene, b - bud, bs - bud-scale, car - caryopsis, fl - flower, fgt(s) - fragment(s), fr - fruit, frst - fruitstone, If, Ivs - leaf, leaves, m - mericarp, n - nut(let), pdm - periderm sac, s - seed, sht(s) - shoot(s), v - vegetative. Latin names follow Clapham *et al.* (1962), Smith (1978) and Paton (1965). () indicates tentative identifications, [] under samples 1 and 4 indicates remains likely to have become incorporated in the turf whilst heaped in the garden (see text).

| Taxon/Sample | Parts | 1 | 4 | 6 |
|---|---|---|---|---|
| ***Flowering plants*** | | | | |
| cf. Aegopodium podagraria L. | m | + | - | - |
| cf. Agrostis sp(p). | car | + | + | ++++ |
| Aira cf. praecox L. | fls, fr | - | + | + |
| cf. Anagallis arvensis L. | s | + | - | - |
| Aphanes microcarpa (Boiss. & Reut.) Rothm. | a | + | (+) | - |
| Atriplex sp(p). | s | + | + | + |
| cf. Avena sp. | lemmas | [+] | - | - |
| Bellis perennis L. | a | + | - | + |
| Betula sp. | fr | - | + | ++ |
| Bromus sp. | car | + | - | - |
| Calluna vulgaris (L.) Hull | fl | ++ | + | + |
| ditto | s | +++ | - | + |
| ditto | v fgts | +++ | + | + |
| Carex spp. | nt | + | +++ | ++ |
| Cerastium sp(p). | s | ++ | + | + |

| | | | | |
|---|---|---|---|---|
| Chenopodium album L. | s | + | - | - |
| Crataegus sp./Prunus spinosa L. | thorn | [+] | - | - |
| Epilobium sp. | s | - | - | + |
| Erica cinerea L. | s | + | - | (+) |
| E. tetralix L. | lvs | +++ | ++ | + |
| ditto | s | + | - | - |
| cf. Erophila sp. | s | + | + | + |
| Fagus sylvatica L. | bs | [++] | - | + |
| cf. Galeopsis sp. | n | + | - | - |
| Gramineae indet. | car | ++ | ++ | ++ |
| Hydrocotyle vulgaris L. | m | - | - | + |
| Hypericum cf. humifusum L. | s | + | - | - |
| Hypericum sp. | s | - | ++ | - |
| Isolepis setacea (L.) E. Br. | n | + | ++ | +++ |
| Juncus bufonius L. | s | +++++ | ++ | + |
| J. conglomeratus L./J. effusus L. /J. inflexus L. | s | - | - | + |
| Leontodon sp(p). | a | + | - | - |
| Montia fontana ssp. chondrospermum (Fenzl) S. M. Walters | s | + | - | + |
| Odontites verna (Bell.) Dum. | s | - | - | ++ |
| Plantago major L, | s | - | - | + |
| cf. Poa sp(p). | car | ++ | - | - |
| cf. P. annua L. | car | ++ | - | + |
| Polygonum aviculare agg. | fr | + | - | + |
| P. convolvulus L. | fr | - | + | + |
| P. lapathifolium L. | fr | - | + | + |
| Potentilla cf. erecta (L.) Rausch. | a | ++ | +++++ | ++++ |
| Prunella vulgaris L. | n | + | +++ | ++ |
| Quercus sp(p). | bs | [+] | - | ++ |
| Ranunculus Section Ranunculus | a | ++++ | + | ++ |
| Rhinanthus sp. | s | - | - | + |
| Rubus cf. fruticosus agg. | frst | - | - | + |
| Rumex acetosella agg. | fr | + | - | + |
| R. spp. | fr | ++ | - | + |
| Spergula arvensis L. | s | - | - | + |
| Stellaria graminea L. | s | + | - | - |
| S. media (L.) Vill. | s | - | + | + |
| Taraxacum sp. | a | - | - | + |
| Taxus baccata L. | lvs | [+] | - | - |
| Tripleurosperm maritimum (L.) Koch ssp. inodorum (L.) Hyl. ex Vaarama | a | + | - | + |
| Triticum sp. | pdm | [+] | - | + |
| Ulmus sp. | bs, b | - | - | + |
| Umbelliferae indet. | m | + | - | - |
| Urtica dioica L. | a | ++++ | - | + |
| Veronica sp(p). | s | + | - | + |
| Viola sp(p). | s | + | + | + |
| Sum of 'seeds' (see caption) | | 616 | 587 | 302 |

***Mosses***

| | | | | |
|---|---|---|---|---|
| Aloina aloides (Schultz) Kindb. | | | | |
| var. aloides | sht | - | - | + |
| Aulacomnium palustre (Hedw.) Schwaegr. | shts | - | ++ | - |
| cf. Barbula sp. | shts | - | - | + |
| Brachythecium/Eurhynchium sp. | shts | + | - | + |
| Breutelia chrysocoma (Hedw,) Lindb. | sht | - | + | - |
| Calliergon cuspidatum (Hedw.) Kindb. | sht | - | + | + |
| Campylopus pyriformis (Schultz) Brid. | sht | - | - | + |
| Dicranum sp. | shts | - | + | - |
| Eurhynchium praelongum (Hedw.) Br. Eur. | shts | ++ | + | - |
| Hylocomnium splendens (Hedw.) Br. Eur. | shts | - | ++ | ++ |
| Hypnum cupressiforme Hedw. | shts | + | +++ | + |
| Leucobryum glaucum (Hedw.) Angstr. | shts,Ivs | + | - | + |
| Lophocolea bidentata (L.) Dum./ | | | | |
| cuspidata (Nees) Limpr. | shts | - | ++ | - |
| Marsupella cf. emarginata (Ehrh.) Dum. | shts | - | + | - |
| Mnium hornum Hedw. | lf | - | - | t |
| M. sp. | sht | - | - | + |
| Polytrichum sp. | If | - | + | - |
| Pseudoscleropodium purum (Hedw.) Fleisch. | shts | - | ++ | + |
| Racomitrium canescens (Heds.) Brid. | shts | - | + | + |
| R. lanuginosum (Hedw.) Brid. | shts | +++ | + | + |
| cf. Rhytidiadelphus loreus (Hedw.) Warnst. | sht | + | - | - |
| R. squarrosus (Hedw.) Narnst. | shts | - | (+) | + |
| Sphagnum sp(p). | shts,lvs | + | + | - |
| Thuidium tamariscinum (Hedw.) Br. Eur. | shts | - | ++ | ++ |

*Table 3 (following page). List of the most abundant Coleoptera and Hemiptera in six samples from the Pow Bank barn. Abbreviations: n - number of individuals; R - rank position; - percentage of total individuals, for each sample. This is a 'first ten ranks of abundance' (FTRA) list (see Hall and Kenward, 1980), with the addition of records of remaining species with a frequency above three in any sample (in practice, only* Ulopa reticulata*). An asterisk indicates that the record for the most abundant species in the genus or group has been given even if named more closely than indicated in the heading. Live individuals (in parentheses in Table 5) not included.*

| Sample | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | n | R | % | n | R | % | n | R | % | n | R | % | n | R | % | n | R | % |
| Acalypta parvula | 3 | 7 | 2.0 | 16 | 1 | 11.9 | 8 | 2 | 7.1 | - | - | - | - | - | - | - | - | - |
| Ulopa reticulata | I | 30 | 0.7 | 3 | 11 | 2.2 | 1 | 23 | 0.9 | 1 | 10 | 2.6 | - | - | - | - | - | - |
| Homoptera sp. | 2 | 15 | 1.3 | 6 | 6 | 4,5 | 1 | 23 | 0.9 | - | - | - | - | - | - | - | - | - |
| Homoptera sp. | 2 | 15 | 1.3 | 4 | 9 | 3.0 | - | - | - | - | - | - | - | - | - | - | - | - |
| Dyschirius globosus | 1 | 30 | 0.7 | - | - | - | 4 | 8 | 3.6 | - | - | - | - | - | - | - | - | - |
| Acrotrichis sp. | 3 | 7 | 2.0 | 6 | 5 | 4.5 | - | - | - | - | - | - | - | - | - | 4 | 9 | 2.1 |
| Anotylus tetracarinatus | 2 | 15 | 1.3 | 2 | 15 | 1.5 | 1 | 23 | 0.9 | - | - | - | - | - | - | 6 | 6 | 3.1 |
| Xantholinus linearis group | 3 | 7 | 2.0 | 5 | 7 | 3.7 | 3 | 9 | 2.7 | 3 | 1 | 7.7 | - | - | - | 2?! | 11 | 1.6 |
| Quedius boops group | 3 | 7 | 2.0 | 13 | 2 | 9.7 | 7 | 4 | 6.3 | - | - | - | - | - | - | - | - | - |
| Aleocharinae sp. | 4 | 5 | 2.7 | 1 | 23 | 0.7 | 2 | 13 | 1.8 | - | - | - | 1 | 14 | 1.4 | 1 | 29 | 0.5 |
| Aphodius sp. | *2 | 15 | 1.3 | *2 | 15 | 1.5 | 3 | 9 | 2.7 | 2 | 4 | 5.1 | 2 | 7 | 2,7 | *2 | 17 | 1.0 |
| A. sp | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 17 | 1.0 |
| Clambus pubescens | 3 | 7 | 2.0 | 1 | 23 | 0.7 | 1?! | 13 | 1.8 | - | - | - | - | - | - | 1 | 29 | 0.5 |
| C. sp. indet. | - | - | - | - | - | - | - | - | - | - | - | | 3 | 6 | 4.1 | - | - | - |
| Anobium punctatum | 3 | 7 | 2.0 | 3 | 11 | 2,2 | 5 | 6 | 4.5 | 2 | 4 | 5.1 | 4 | 3 | 5.4 | 9 | 3 | 4.7 |
| Ptinusfur | 2 | 15 | 1.3 | 3 | 11 | 2.2 | 3 | 9 | 2.7 | - | - | - | 2 | 7 | 2.7 | 7 | 4 | 3.6 |
| Tipnus unicolor | - | - | - | - | - | - | 1 | 23 | 0.9 | - | - | - | 5 | 2 | 6.8 | 3?! | 9 | 2.1 |
| Orthoperus sp. | 8 | 3 | 5,4 | 4 | 9 | 3.0 | 6 | 5 | 5.4 | 3 | 1 | 7.7 | 4 | 3 | 5.4 | 7 | 4 | 3.6 |
| Hycetaea hirta | 15 | 1 | 10.1 | 11 | 3 | 8.2 | 8 | 2 | 7.1 | (3) | _ | _ | 15 | 1 | 20.3 | 1 | 29 | 0.5 |
| Lathridius minutus group | 3 | 7 | 2.0 | 2 | 15 | 1.5 | 1 | 23 | 0.9 | 3 | 1 | 7.7 | - | - | - | 6 | 6 | 3.1 |
| Dienerella filiformis/filum | 4 | 5 | 2.7 | 2 | 15 | 1.5 | 9 | 1 | 8.0 | - | - | - | - | - | - | 12 | 1 | 6.2 |
| Corticariinae sp. | 10 | 2 | 6.7 | 10 | 4 | 7.5 | 3 | 9 | 2.7 | (1) | - | - | 4 | 3 | 5.4 | 10 | 2 | 5.2 |
| Altica sp. | 6 | 4 | 4.0 | 3 | 11 | 2.2 | 1 | 23 | 0.9 | - | - | - | - | - | - | 1 | 29 | 0.5 |
| Longitarsus sp. | 2 | 15 | 1.3 | 1 | 23 | 0.7 | 5 | 6 | 4.5 | ?! | 10 | 2.6 | 2 | 7 | 2.7 | 2 | 17 | 1.0 |
| Strophosomus sus | 3 | 7 | 2.0 | 5 | 7 | 3.7 | 2 | 13 | 1.8 | 2 | 4 | 5.1 | - | - | - | 1 | 29 | 0.5 |
| Sitona hispidulus | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2?3 | 8 | 2.6 |

*Table 4. Main statistics of the assemblages of Coleoptera and Hemiptera from the Pow Bank turf roof and barn floor. Weights and concentrations have not been used since undecayed plant matter formed a large part of most samples. The index of diversity is α of Fisher* et al. *(1943), calculated using a computer program written by ARH. OA - certain 'outdoor' species; OB - certain plus probable 'outdoor' species.*

| **Sample number** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| Number of individuals (N) | 149 | 134 | 112 | 39 | 74 | 183 |
| Number of species (S) | 77 | 48 | 50 | 27 | 38 | 99 |
| Index of diversity (alpha) | 64.1 | 26.8 | 34.7 | 39.1 | 31.5 | 88.0 |
| Standard error of alpha | 9.0 | 7.4 | 5.4 | 12.9 | 6.3 | 11.4 |
| Number of outdoor spp (OA) | 30 | 24 | 18 | 14 | 11 | 28 |
| Number of outdoor individuals (OA) | 45 | 59 | 34 | 17 | 12 | 38 |
| Number of outdoor species (OB) | 35 | 27 | 21 | 16 | 14 | 36 |
| Number of outdoor individuals (OB) | 51 | 62 | 40 | 20 | 16 | 47 |
| Percentage outdoor individuals (OA) | 30.2 | 44.0 | 30.4 | 43.6 | 16.2 | 20.8 |
| Percentage outdoor individuals (OB) | 34.2 | 46.3 | 35.7 | 51.3 | 21.6 | 25.7 |
| Number of aquatic individuals (W) | 1 | 0 | 2 | 0 | 0 | 2 |
| Number of waterside individuals (D) | 1 | 1 | 0 | 0 | 0 | 0 |
| Percentage of aquatic individuals (W) | 0.7 | 0.0 | 1.8 | 0.0 | 0.0 | 1.1 |
| Percentage of waterside individuals (D) | 0.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Percentage (W+D) individuals | 1.3 | 0.7 | 1.8 | 0.0 | 0.0 | 1.1 |
| Number of decomposer species (Rt) | 24 | 16 | 22 | 7 | 18 | 39 |
| Number of Rt individuals | 74 | 53 | 55 | 15 | 49 | 105 |
| Percentage of Rt individuals | 49.7 | 40.0 | 49.1 | 38.5 | 66.2 | 57.4 |
| Number of 'dry compost' species (Rd) | 5 | 4 | 10 | 1 | 5 | 8 |
| Number of Rd individuals | 23 | 18 | 28 | 3 | 26 | 26 |
| Percentage of Rd individuals | 15.4 | 13.4 | 25.0 | 7.7 | 35.1 | 14.2 |
| Number of foul-matter species (Rf) | 4 | 4 | 2 | 2 | 4 | 8 |
| Number of Rf individuals | 5 | 5 | 4 | 3 | 5 | 14 |
| Percentage of Rf individuals | 3.4 | 3.7 | 3.6 | 7.7 | 6.8 | 7.7 |

*Table 5. Records of live insects in the samples from the Pow Bank barn. The specimens were recognized by being entire and containing viscera after extraction.* S. hispidulus *is a typical component of the 'background fauna', often abundant in roof assemblages. The remaining species are a group likely to be found breeding in rather dry decaying plant matter in a building or deep accumulation*

| **Sample number** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| Ptenidium ?nitidum | 1 | - | - | - | - | - |
| Hycetaea hirta | 5 | 14 | 7 | 3 | - | - |
| Lithostygnus serripennis | - | - | - | 1 | - | - |
| Dienerella sp. | - | 4 | 10 | - | - | - |
| Corticariinae | 6 | 22 | 11 | 1 | - | - |
| Sitona hispidulus | - | - | - | - | - | 1 |

*Table 6. Heathland and moorland insects (*), and those which are rather characteristic of such vegetation, from the Pow Bank barn samples.* Myrmica sulcinodis*, an ant associated with moorland habitats, was also tentatively recorded from samples 1 and 3*

| **Samples** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| Acalypta parvula | 3 | 16 | 8 | 0 | 0 | 0 |
| Ulopa reticulata* | 1 | 3 | 1 | 1 | 0 | 0 |
| Dyschirius globosus | 1 | 0 | 4 | 0 | 0 | 0 |
| Olisthopus rotundatus | 0 | 2 | 0 | 0 | 0 | 0 |
| Bradycellus ruficollis* | 0 | 2 | ?1 | 0 | 0 | 0 |
| Quedius boops group | 3 | 13 | 7 | 0 | 0 | 0 |
| Lochmaea suturalis* | 0 | 0 | 1 | 0 | 0 | 0 |
| Altica ?ericeti | 6 | 3 | 1 | 0 | 0 | 1 |
| Strophosomus sus* | 3 | 4?1 | 2 | 2 | 0 | 1 |
| | | | | | | |
| Number of individuals (*) | 4 | 10 | 5 | 3 | 0 | 1 |
| Total individuals | 17 | 44 | 25 | 3 | 0 | 2 |
| *% | 2.7 | 7.7 | 4.5 | 7.7 | 0.0 | 0.5 |
| Total % | 11.4 | 32.8 | 22.3 | 7.7 | 0.0 | 1.1 |

*Table 7. Full species lists of insects from six samples from turf and the barn floor, Pow Bank. Number of individuals is the minimum number which could have given recorded remains. Difficult identifications were not pursued unless precise determination was needed to place the specimens in an ecological category. The ecological codes are as follows: OA - certain outdoor; OB - probable outdoor (OB of Table 4 is calculated from the sum of species coded OA and OB); W - obligate aquatic and waterside; D - waterside or damp ground; Rt - rotting matter in general; Rd - dryish rotting matter; Rf - foul rotting matter; L - wood; M - moorland and heathland. The order of species follows Kloet and Hincks (1964, 1977) and author abbreviations, where used, Joy (1932, vol. 1, p. xx). Where 'ditto' is used it indicates further species within that sample.*

| **Taxon** | **Code** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|---|
| **Hemiptera** | | | | | | | |
| ?Drymus brunneus (Sahib.) | OA | - | - | 1 | - | - | - |
| ?Lygaeidae sp. | OA | - | 1 | - | - | - | - |
| Acalypta parvula (Fallen) | OA | 3 | 16 | 8 | - | - | - |
| Cimicidae sp. | OB | - | - | - | - | - | 1 |
| Ulopa reticulata (F.) | OA | 1 | 3 | 1 | 1 | - | - |
| Aphidoidea sp. | OA | - | - | - | - | - | 1 |
| Homoptera - Fulgoroidea | OA | 2 | 6 | 1 | - | - | - |
| ditto | OA | 2 | 4 | - | - | - | - |
| ditto | OA | 1 | 1 | - | - | - | - |
| **Coleoptera** | | | | | | | |
| Notiophilus sp. | OA | - | 1 | - | 1 | - | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Loricera pilicornis (F.) | OA | 1 | - | - | - | - | - |
| Nebria sp. | OA | - | - | - | - | - | 1 |
| Dyschirius globosus (Hbst.) | OB | 1 | - | 4 | - | - | - |
| Trechus obtusus Er. or quadristriatus (Schrank) | OA | - | - | - | - | 1 | - |
| Bembidion lampros (Hbst.) or properans St. | OA | - | - | - | 2 | - | 1 |
| B. ?obtusum Sen. | OA | - | - | - | 1 | - | - |
| B. (Philochthus) sp. | OA | - | 1 | - | ?1 | - | 1 |
| B. sp. | OA | 1 | - | - | - | - | - |
| Pterostichus ?nigrita (Pk.) | OA,D | - | 1 | - | - | - | - |
| ?P. strenuus (Pz.) | OB | - | - | - | - | - | 1 |
| ?P. (Poecilus) sp. | OA | 1 | - | - | 1 | - | - |
| ?P. sp. (small) | OB | - | 1 | - | - | - | - |
| ?Calathus fuscipes (Goeze) | OA | - | 1 | - | - | - | - |
| Olisthopus rotundatus (Pk.) | OA | - | 2 | - | - | - | - |
| Agonum ?muelleri (Hbst.) | OA | - | 1 | - | - | - | - |
| ?A. sp. | OA | 1 | - | - | - | - | - |
| Amara sp. | OA | - | 2 | - | - | 1 | - |
| ?Harpalus rufipes (Degeer) | OA | - | - | - | - | - | 1 |
| Bradycellus ruficollis (Steph. | OA, M | - | 2 | ?1 | - | - | - |
| Carabidae spp. | OA | 1 | - | 1 | 1 | - | 1 |
| Helophorus sp. (small) | OA, W | - | - | 2 | - | - | 2 |
| Cercyon analis (Pk.) | Rt | - | - | - | - | 1 | 1 |
| Cercyon pygmaeus (Ill.) | Rf | - | - | 1 | - | - | - |
| C. ?haemorrhoidalis (F.) | Rf | - | - | - | - | - | 1 |
| C. terminatus (Marsh.) | Rf | 1 | - | - | - | - | - |
| C. melanocephalus (L.) | Rf | - | - | - | - | - | 2 |
| C. sp. | Rt | - | - | - | - | - | 2 |
| Megasternum obscurum (Marsh.) | Rt | 2 | - | - | 2 | - | 2 |
| Hydrophilinae sp. | OA,W | 1 | - | - | - | - | - |
| Onthophilus striatus (Forst.) | Rt | - | - | - | - | - | 1 |
| Ptenidium ?nitidum (Heer) | Rt | (1) | - | - | - | - | - |
| P. sp. | Rt | - | - | 1 | - | 1 | ?1 |
| Acrotrichis spp. | Rt | 3 | 6 | - | - | - | 4 |
| Leiodes sp. | - | - | - | - | - | - | 1 |
| Catopinae sp. | - | - | - | 1 | - | - | - |
| Silpha atrata L. | OB | - | - | - | - | - | 1 |
| Scydmaenidae sp. | - | 1 | - | - | - | - | - |
| Micropeplus sp. | - | - | - | - | - | 1 | - |
| Proteinus sp. | Rt | - | - | - | - | - | 1 |
| Megarthrus sp. | Rt | 1 | - | - | - | - | 1 |
| Anthobium sp. | OB | - | - | - | - | - | 1 |
| Olophrum ?fuscum (Gr.) | OB | 1 | - | - | - | - | - |
| Acidota cruentata Man. | OB | - | - | 1 | - | - | - |
| Lesteva sp. | OA,D | 1 | - | - | - | - | - |
| Omalium italicum Bern. group | Rt | 1 | - | - | - | - | - |
| O. excavatum Steph. | Rt | - | - | - | - | - | 2 |
| Xylodromus ?concinnus (Marsh.) | Rt | 2 | - | - | 1 | - | 3 |
| Omaliinae sp. | - | - | - | - | - | - | 1 |
| Carpelimus rivularis (Mots.) or bilineatus Steph. | - | - | - | - | - | - | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C. sp. (small) | OB | - | - | 1 | - | - | 1 |
| Aploderus caelatus (Gr.) | Rt | 1 | 1 | - | - | - | 1 |
| Platystethus arenarius (Fourc.) | Rf | - | 1 | - | - | 1 | 3 |
| Anotylus rugosus (F.) | Rt | 2 | - | 1 | - | 1 | 2 |
| A. sculpturatus (Gr.) group | Rt | - | - | - | - | - | 1 |
| A. tetracarinatus (Block) | Rt | 2 | 2 | 1 | - | - | 6 |
| Oxytelus laqueatus (Marsh.) | Rf | - | - | - | - | - | 2 |
| O. sculptus Gr. | Rt | - | - | 1 | - | - | - |
| Stenus spp. | - | 1 | 2 | 2 | - | - | 1 |
| Othius sp. | - | - | - | - | 1 | - | - |
| Gyrohypnus fracticornis (Mull.) | Rt | 1 | - | - | - | - | 1 |
| Xantholinus linearis (Ol.) group | Rt | 3 | 5 | 3 | 3 | - | 2?1 |
| Philonthus sp. | - | - | 1 | - | 1 | - | 2 |
| ditto | - | - | - | - | - | - | 1 |
| P. or Gabrius sp. | - | 1 | - | - | 1 | - | 1 |
| Quedius boops (Gr.) group | - | 3 | 13 | 7 | - | - | - |
| Q. sp. | - | ?1 | - | - | - | 2 | 1 |
| ditto | - | - | - | - | - | - | 1 |
| Staphylininae indet. | - | - | 1 | - | - | 1 | - |
| Mycetoporus sp. | - | 1 | - | - | - | - | ?! |
| Tachyporus ?nitidulus (F.) | - | 1 | - | - | - | - | - |
| T. sp. | - | - | - | 1 | - | - | 1 |
| Tachinus cf. laticollis Gr. | - | 1 | - | - | - | - | 1 |
| T. ?signatus Gr. | - | 1 | - | - | - | 1 | - |
| T. sp. | - | - | - | - | - | - | 1 |
| Autalia ?rivularis (Gr.) | Rt | - | - | - | - | - | 1 |
| Aleocharinae sp. | - | 4 | 1 | 2 | - | 1 | 1 |
| ditto | - | 2 | 1 | 1 | - | - | 1 |
| ditto | - | 2 | 1 | 1 | - | - | 1 |
| ditto | - | - | 1 | 1 | - | - | 1 |
| ditto | - | - | - | - | - | - | 1 |
| ditto | - | - | - | - | - | - | 1 |
| ditto | - | - | - | - | - | - | 1 |
| Geotrupes sp. | OA,Rf | - | - | - | - | - | 1 |
| Colobopterus ?fossor (L.) | OA,Rf | 1 | - | - | - | - | - |
| Aphodius ?contaminatus (Hbst.) | OA,Rf | - | - | - | - | - | 2 |
| A. fimetarius (L.) | OA,Rf | - | 2 | - | - | - | ?1 |
| A. cf. prodromus (Brahm) | OB,Rf | 2 | - | - | - | - | - |
| A. sp. (patterned) | OA,Rf | - | - | 3 | - | - | - |
| A. spp. | OB,Rf | 1 | 1 | - | 2 | 2 | 2 |
| ditto | OB,Rf | - | 1 | - | 1 | 1 | - |
| ditto | OB,Rf | - | - | - | - | 1 | - |
| ?Phyllopertha horticola (L.) | OA | 1 | - | - | - | - | - |
| Clambus pubescens Redt. | Rt | 3 | 1 | 1?1 | - | - | 1 |
| Clambus sp. indet. | Rt | - | - | - | - | 3 | - |
| Byrrhidae | OA | - | - | - | 1 | - | - |
| Ctenicera cuprea (F.) | OA | - | - | - | 1 | - | - |
| Athous ?haemorrhoidalis (F.) | OA | - | - | - | 2 | - | - |
| Elateridae sp. | OB | 1 | - | - | - | - | 1 |
| Attagenus pellio (L.) | Rt | 1 | - | - | - | 2 | 1 |
| Anobiuin punctatum (Degeer) | L | 3 | 3 | 5 | 2 | 4 | 9 |
| Ptinus fur (L.) | Rd | 2 | 3 | 3 | - | 2 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tipnus unicolor (Pill. and Mitterpacher) | Rd | - | - | 1 | - | 5 | 3?1 |
| Niptus hololeucus (Fald.) | - | - | - | - | - | 1 | 1 |
| Rhizophagus sp | - | - | - | - | - | - | 1 |
| Cryptophagus sp. | Rd | 2 | 1 | 2 | - | 2 | 3 |
| ditto | Rd | - | - | 1 | - | 2 | - |
| Atomaria sp. | Rd | 1 | - | 2 | - | - | 3 |
| ditto | Rd | - | - | 1 | - | - | 1 |
| Orthoperus sp?p. | Rt | 8 | 4 | 6 | 3 | 4 | 1 |
| Mycetaea hirta (Marsh.) | Rd | 15(5) | 11(14) | 8(7) | (3) | 15 | 1 |
| Lithostygnus serripennis Broun | - | - | - | - | (1) | - | 1 |
| Aridius nodifer (West.) | - | - | - | - | - | - | 1 |
| Lathridius minutus (L.) group | Rd | 3 | 2 | 1 | 3 | - | 6 |
| Enicmus sp. | Rd | - | - | 2 | - | - | - |
| Dienerella filiforinis (Gyll.) or filum (Aubé) | Rt | 4 | 2(4) | 9(10) | - | - | 12 |
| Corticariinae | Rt | 10(6) | 10(22) | 3(11) | (1) | 4 | 10 |
| ditto | Rt | 1 | - | 2 | - | 1 | 1 |
| ditto | Rt | 1 | - | - | - | 1 | 1 |
| Cis sp. | L | 1 | - | - | - | - | - |
| Typhaea stercorea (L.) | Rd | - | - | 1 | - | - | 1 |
| Anaspis sp. | - | - | - | - | - | - | 1 |
| ?Chrysolina sp. | OA | - | - | - | - | - | 1 |
| Lochmaea suturalis (Th.) | OA,M | - | - | 1 | - | - | - |
| Altica ?ericeti (Al.) | OA | 6 | 3 | 1 | - | - | 1 |
| Crepidodera sp. | OA | 1 | - | - | - | - | - |
| Longitarsus spp. | OA | 2 | - | 5 | ?1 | 2 | 2 |
| ditto | OA | 2 | - | 2 | - | - | 1 |
| ditto | OA | 1 | - | - | - | - | - |
| Halticinae sp. (green) | OA | 1 | - | - | 1 | 1 | - |
| Halticinae spp. (others) | OA | - | 1 | 1 | - | - | - |
| ditto | OA | - | 1 | - | - | - | - |
| ditto | OA | - | 1 | - | - | - | - |
| ditto | OA | - | 1 | - | - | - | - |
| Apion (Erythrapion) sp. | OA | - | - | - | - | 1 | - |
| Apion spp. | OA | 2 | - | 1 | 1 | - | 1 |
| ditto | OA | 1 | - | - | - | - | 1 |
| Otiorhynchus ?rugostriatus (Goeze) | OA | - | - | - | - | 1 | - |
| Otiorhynchus sp. | OB | - | - | - | - | - | 1 |
| Phyllobius or Polydrusus sp. | OA | 1 | - | - | - | - | - |
| Strophosomus sus Steph. | OA,M | 3 | 4?1 | 2 | 2 | - | 1 |
| Sitona hispidulus (F.) | OA | - | - | - | - | - | 2?3(1) |
| S. lepidus Gyll. or puncticollis Steph. | OA | 2 | - | - | - | - | 3 |
| S. sp. | OA | 1 | - | - | - | 1 | 2 |
| ditto | OA | - | - | - | - | 1 | - |
| Hypera punctata (F.) | OA | 1 | - | - | - | ?1 | 1 |
| Cidnorhinus quadrimaculatus (L.) | OA | - | - | - | - | - | 1 |
| Ceutorhynchus sp. | OA | - | 1 | 1 | - | 1 | - |
| ditto | OA | - | 1 | - | - | - | - |
| Ceuthorhynchinae spp. | OA | - | - | - | - | - | 1 |
| ditto | OA | - | - | - | - | - | 1 |

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|---|---|---|---|---|---|---|---|---|
| ditto | OA | - | - | - | - | - | 1 |
| Curculionidae spp. | OA | 1 | 1 | - | - | 1 | 1 |
| ditto | OA | 1 | - | - | - | - | - |
| ditto | OA | 1 | - | 1 | - | - | - |
| Dryocoetinus villosus (F.) | L | - | - | - | - | 1 | - |
| Scolytidae sp. | L | - | - | - | - | - | 1 |
| Coleoptera sp. | - | 1 | - | - | 1 | - | 1 |
| ditto | - | 1 | - | - | 1 | - | - |
| **Hymenoptera: Formicidae** | | | | | | | |
| Myrmica ?sulcinodis Nylander | - | 2 | - | 2 | - | - | - |
| Myrmica ?rubra (L.) | - | - | - | 1 | - | - | - |
| M. sp. | - | 2 | 1 | 2 | 4 | - | - |
| cf. Lasius sp. | - | - | - | - | - | - | 1 |