

**Insect remains from pit [3067],  
Aylesbury Berryfields, Buckinghamshire**

(Site Code AYLBER10)

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*Canterbury Archaeological Trust Report 2018/65*

April 2018

## INTRODUCTION

The Berryfields major development area lies to the north-west of Aylesbury in Buckinghamshire, extending both north and south of the A41 (NGR SP 787 160). The samples examined for insect remains came from pit [3067] which had been cut through the fills of an earlier pond [3062]. The fills of the pond appear to have accumulated in the second century AD (Phase 5). The pit may have initially functioned as a water tank, but subsequently a number of structured deposits were placed into it, possibly to mark its disuse. Finds from the pit included metal objects, brooches, over 40 coins, near-complete pots, animal burials, worked timber, leather and a basket of eggs. Ceramic and coin evidence indicates that the fill of pit [3067] accumulated after AD270 (Phase 6) (Edward Biddulph, pers. comm.).

Seven samples from the waterlogged fills of pit [3067] were initially examined for insect remains (Allison 2017) and two were selected for detailed analysis: sample <193> representing the primary fill (context 3074) and sample <227> representing the later fill containing the placed items. In addition, three smaller incremental samples taken from the top, middle and bottom of the primary fill were scanned to investigate whether any changes in the depositional environment had occurred over the time that the deposit had accumulated.

## METHODS

The analysed samples had volumes of 5 litres and the three incremental samples volumes of 1 litre. All were received having been wet-sieved to 0.25mm at OAS. Paraffin flotation to extract insect remains was carried out following the methods of Kenward *et al.* (1980) with recovery on 0.3mm mesh.

The paraffin flots from the analysed samples were large and extremely rich in insect remains (estimated 800+ individuals). It was estimated that over half of the taxa represented were aquatic and these were recorded by scanning under a low-power stereoscopic zoom microscope (x10). Terrestrial insects were investigated in more detail since they have the potential to provide information on habitats and vegetation in the vicinity of the feature and local land use. Sclerites of terrestrial beetles (Coleoptera) and bugs (Hemiptera) were removed from the paraffin flots onto moist filter paper for examination (x10 – x45). Identification was by comparison with modern insect material and with reference to standard published works. Minimum numbers of individuals and taxa of beetles and bugs were recorded, and taxa were divided into broad ecological groups for interpretation based on Kenward *et al.* (1986) and Kenward (1997). The paraffin flots from the three incremental samples were scanned in industrial methylated spirits (IMS) at x10 magnification and the principal taxa were noted.

Nomenclature of Coleoptera and Hemiptera follows Duff (2012a) and the systematic lists compiled from various sources on the British Bugs website (Bantock and Botting 2018). Information on host plants of plant-feeding species in the main text and Table 1 has been obtained from Cox (2007), Hodkinson and White (1979), Le Quesne (1960), Morris (1990, 1997, 2003, 2008, 2012), Nau (2004) and Southwood and Leston (1959) unless otherwise stated. The extracted insects and the paraffin flots are currently stored in IMS.

## THE INSECT ASSEMBLAGES

### *General comments*

The deposits were rich in insect remains with concentrations of beetles and bugs estimated to be in the order of 150 – 200 individuals per litre. The recovered assemblages are described below beginning with the earliest. Proportions of various ecological groups among the terrestrial fauna in each of the fully analysed samples are shown in Figure 1, hosts of strongly plant-associated taxa in Table 1, and lists of taxa recorded from individual samples in Table 2.

### **Context 3074 - primary fill of pit [3067]**

(sample <193>; incremental samples <219>, <215> and <212>)

The analysis for this deposit focused on sample <193>. Deposition was clearly under aquatic conditions: several hundred aquatic beetles and bugs were represented with *Helophorus* spp., *Limnebius*, and *Ochthebius minimus* the most abundant taxa. Fragments of caddis fly larvae (Trichoptera), water flea ephippia (Cladocera: resting eggs) and ostracod carapaces were also recorded. Most of the closely identified water beetles are typical of still to slowly flowing waters and some species, including *Graptodytes pictus* and *Hygrotus inaequalis*, indicate that the water within the feature was permanent and well-vegetated. The occurrence of at least 11 specimens of three species of riffle beetle (Elmidae), however, suggests that there was an input of clean, clear running water from a spring or running water channel. *Ochthebius bicolon* is also suggestive of running water (Duff 2012b, 326). Duckweed (*Lemna*) growing on the water surface was indicated by the tiny aquatic weevil *Tanysphyrus lemnae*.

Sample <228>, also from this context, was scanned as part of the assessment but no riffle beetles (Elmidae) were observed (Allison 2017). The contrast with sample <193> raised the possibility that depositional conditions may have changed during the accumulation of the primary fill. Since it was unclear from the site records how samples <193> and <228> related to one another, the aquatic component of the three incremental samples from the bottom, middle and top of context 3074 were scanned as part of this analysis. The range of water beetles and bugs in all three samples was in most respects very similar to that seen in sample <193>, with all assemblages dominated by *Helophorus* spp., *Ochthebius minimus* and *Limnebius*. Additional taxa noted were *Agabus nebulosus* and *Hygrotus impressopunctatus*. In terms of aquatic conditions, the only significant difference between the assemblages from the three samples was that several individuals of the riffle beetle *Oulimnius* were present in the lowermost (sample <219>) but none were recorded from the other two samples. This suggests that sample <193> may represent the basal part of context 3074. The possible implications for water conditions are discussed further below.

A large assemblage of terrestrial insects was recorded from sample <193> (a minimum of 382 beetles and bugs of 193 taxa). Damp ground/waterside taxa accounted for 12% of these: *Bembidion lunulatum* found on bare damp soils near water was common (11 individuals) and *Dryops* and *Heteroceris* are found in wet waterside mud. *Conomelus anceps* (a leafhopper) is found on rushes (*Juncus*), and larvae and adults of *Prasocuris phellandrii* feed primarily on marsh marigold (*Caltha palustris*) although the adults can be found on various wetland plants, commonly including various waterside umbellifers (Apiaceae; Harde

1984, 276) for which there was abundant plant evidence (Meen, plant report). Soldier beetles (Cantharidae) were common and may also have been associated with umbellifers since they often congregate on the flowerheads for mating. Plants growing close to the feature are likely to have included nettles (*Urtica*), indicated by shed nymphal skins of *Trioza urticae* (a jumping plant louse), *Brachypterus* and, in one of the incremental samples, nettle ground bug (*Heterogaster urticae*). Docks (*Rumex*) were indicated by *Rhinoncus ?pericarpus* and *Coreus marginatus*, and common mallow (*Malva sylvestris*) by *Malvapion malvae*. There may also have been woody vegetation: the weevils *Orchestes* and *Ramphus* are found on the foliage of trees and shrubs, and habitats associated with dead or dying wood were suggested by *Bitoma crenata* found on dead bark, and two species of bark beetles (Scolytinae). Scale insects found on the branches of various trees and shrubs were also recorded (Coccoidea, Diaspidinae). Woodworm beetles (*Anobium punctatum*) were quite common and could have infested dry dead wood of deciduous trees or perhaps timber fragments within the deposit or any wooden structures that may have been situated close to the feature.

Various ground beetles (Carabidae) indicated that ground away from the feature was generally rather dry and open (e.g. *Calathus fuscipes*, *Brachinus crepitans*, *Stomis pumicatus*, *Anchomenus dorsalis*, *Ophonus* spp.) and phytophagous taxa were suggestive of disturbed ground and grassland. *Phyllotreta* and *Ceutorhynchus* species predominantly feed on crucifers (Brassicaceae) with *Ceutorhynchus erysimi* specifically associated with shepherd's purse (*Capsella bursa-pastoris*), and *Chaetocnema concinnalpicipes* is usually associated with knotweeds (*Polygonum*). Taxa typical of grassland habitats included *Longitarsus*, numerous apionid weevils including *Ceratopion carduorum* found on thistles (*Cirsium* and *Carduus*), *Sitona* spp. found on Fabaceae, and *Mecinus labile* and *M. pascuorum* found on ribwort plantain (*Plantago lanceolata*). The ground beetle *Ophonus ardosiascus* can often be found feeding on the seeds of wild carrot (*Daucus carota*; Duff 2012b, 222). Larvae of *Phyllopertha horticola* (a small chafer) feed at turf roots and the species is characteristic of poor quality permanent grassland on light soils where there is a diversity of flowering plants and a high proportion of weeds (Raw 1951).

Scarabaeid beetles primarily associated with herbivore dung accounted for 3% of the terrestrial fauna; species represented included *Aphodius erraticus*, *A. contaminatus*, *A. prodromus/sphacelatus*, and *A. fimetarius*. Modern studies suggest that such a proportion would indicate low-level or 'naturalistic' grazing (Smith *et al.* 2010; 2014). *Aphodius* larvae develop in fresh dung and a record of an unexpanded *A. contaminatus* elytron (from an unemerged or emerging beetle) suggests that some animals were close enough for their dung to have entered the water.

Beetles that are regarded as synanthropic to some degree accounted for 15% of the terrestrial fauna. Two-thirds of these are categorized as facultative synanthropes, i.e. common in natural habitats although clearly favoured by artificial ones (Kenward 1997), but the rest include a group of beetles (5% of the terrestrial fauna) that are characteristically found together in association with litter from within ancient buildings (*Typhaea stercorea*, *Crataraea suturalis*, *Latridius minutus* group, *Enicmus*, *Cryptophagus* spp., *Ephistemus globulus*; Carrott and Kenward 2001; Hall and Kenward 1990; Kenward and Hall 1995). The building fauna and other synanthropes typically associated with organic occupation waste were not common enough to indicate direct dumping of substantial quantities of such

material in the feature; the material may therefore have arrived in run-off/drainage from occupation or manured land.

Terrestrial beetles and bugs noted during scanning the incremental samples were consistent with the records from the larger analysed sample <193>.

***Context 3073 – secondary fill of pit [3067] containing placed items***  
(sample <227>)

It was estimated that over half of the very large insect assemblage consisted of aquatic beetles and to a lesser extent bugs. Water flea ephippia and ostracods were also common and aquatic deposition was clearly indicated. The range of water beetles was very similar in many respects to those recorded from the primary fill. Taxa not seen in the earlier deposit included *Coelostoma orbiculare* which occurs at the edges of water bodies and in floating rafts of vegetation, usually in association with mosses and *Helochaetes lividus* found in vegetated waters (Foster *et al.* 2014, 72, 63). A single riffle beetle (*Oulimnius*) was recorded suggesting that there may have been an input of clean, clear running water at least occasionally.

A minimum of 474 individuals of 163 terrestrial taxa was recorded. Ground around the feature might have been marshier than previously since damp ground/waterside taxa were very well-represented among terrestrial insects (21%). Marsh beetles (*Cyphon*, at least 51 individuals) whose larvae develop in shallow water were particularly well-represented, and *Bembidion lunulatum*, *Dryops* and *Heterocerus* provided evidence for damp bare ground and wet mud. Insects associated with wetland vegetation included *Prasocuris phellandrii* (at least six individuals), particularly associated with marsh marigold (*Caltha palustris*), *Conomelus anceps* and *Livia junci* found on rushes (*Juncus*), and *Coccidula rufa*, a spotless ladybird usually associated with tall wetland vegetation such as reeds (*Phragmites*), rushes (*Juncus*), and reedmace (*Typha*) (Majerus 1994, 142). Evidence for nettles and docks came from *Brachypterus*, *Trioza urticae* nymphs, *Apion*, and an adult and ?nymph of *Coreus marginatus*. Rotten wood and woody vegetation close to the feature were suggested by *Sinodendron cylindricum* and two species of bark beetles (Scolytinae).

Although there were suggestions of disturbed ground from beetles found on Brassicaceae (*Phyllotreta nemorum* group, *Ceutorhynchus* spp.), drier ground away from the pit was probably predominantly grassland. A striking feature of the assemblage was the abundance of click beetles (Elateridae) including several *Agrypnus murinus* and numerous *Agriotes*; both taxa are common in grassland where their larvae feed on plant roots. Phytophages included *Sphaeroderma* found on thistles or knapweeds, *Graptus triguttatus* on ribwort plantain (*Plantago lanceolata*), *Oxystoma* on vetches (*Vicia* and *Lathyrus*), *Gampsocoris punctipes* on restharrow (*Ononis*), and *Sitona* spp. and *Tychius* on Fabaceae. Tying in with evidence for grassland, scarabaeid dung beetles were proportionally more common than in the primary fills, suggesting that there was more intensive use of nearby land for grazing by this stage (*Aphodius contaminatus*, *A. prodromus* or *sphacelatus*, *A. erraticus*, *A. ater*, *Onthophagus ?joannae*; 8% of the terrestrial fauna).

Beetles that are regarded as synanthropic to some degree accounted for 8% of the terrestrial fauna, somewhat less than in the primary fill. They did however include a group of beetles that are characteristically found together in association with litter from within ancient buildings (*Ptinus fur*, *Latridius minutus* group, *Enicmus*, *Cryptophagus* spp., *Ephistemus*

*globulus*; 5% of the terrestrial fauna), perhaps introduced in run-off/drainage from occupation or manured land.

## DISCUSSION AND CONCLUSIONS

### *Aquatic conditions*

The bulk of the aquatic beetle fauna was indicative of standing water but the presence of several species of riffle beetle (Elmidae) in the basal parts of the primary fill of the pit (context 3074) suggests an input of clean, clear, running water into the pit at least occasionally. This could have been from a nearby spring or stream. Riffle beetles were not observed in the middle and upper incremental samples from context 3074, but a single specimen of one species (*Oulimnius*) was recorded from the later fill (context 3073), suggesting that running water entered the pit at least occasionally at that stage too. While it is quite possible that the water source was intermittent, the apparent decline in number and species of riffle beetles between the earliest and later fills might possibly also reflect a decline in water quality in the source, perhaps in the form of silting or reduced oxygenation as a result of human activity. Riffle beetles have a plastron respiration system which requires a continuous supply of clean, clear, well-oxygenated running water. They do not swim but cling tenaciously to the substrate to avoid being swept away, even during episodes of flooding (Brown 1987; Shotton and Osborne 1986). A modern study has shown that the presence or absence of silt in the water is the single most important factor affecting their distribution (Eyre *et al.* 1993). Archaeological evidence indicates that riffle beetles appear to have been more widely distributed in the earlier part of the Holocene and it has been suggested that their disappearance from many lowland rivers might have been linked to an increase in the silt content of the water in many areas during and after phases of alluviation that took place from the Late Bronze onwards (Osborne 1988).

### *Terrestrial conditions and local land use*

Terrestrial insects from small water bodies generally reflect ecological conditions in the near vicinity of a particular feature. A modern study of insect remains from sediments in a well in Kent, for example, found that they provided a good representation of known habitats in its immediate surroundings (Hall *et al.* 1980, 132). Another study of small water bodies has shown that even mobile taxa such as scarabaeoid dung beetles will have arrived from within a 100-200 metre radius (Smith 2010).

Ground immediately around pit [3067] appears to have been damp with areas of bare wet mud. Vegetation growing fairly close to the pit probably included rushes, nettles, docks, members of the buttercup family (Ranunculaceae), and common mallow. Small numbers of beetles associated with dead or rotten wood in both samples, and scale insects found on twigs or branches and weevil that feed on foliage of woody vegetation in the primary fill, provided a hint that trees or shrubs might have grown close to the pit. There was very limited pollen evidence for this, however (Rutherford, pollen report), but it is possible that these insects represent a dead or dying tree or shrub or perhaps even a well-maintained hedgerow that produced few flowers. Woodworm beetles (*Anobium punctatum*), probably present in both samples but only tentatively identified from the secondary fill, could have infested dry dead

naturally occurring wood, any timber structures close to the pit, or perhaps some of the pieces of wood that were observed in both fills. In the last case, however, no signs of wood boring were noted during examination of recovered timber fragments (Goodburn-Brown, wood report).

Numerous insects indicated that away from the pit conditions were generally dry and open. The main implication of the terrestrial insects from both deposits was for dry grassland habitats with an abundance of flowering plants, and evidence was particularly strong from the secondary fill (context 3073). Modern studies of dung beetle remains in insect assemblages from small water bodies have shown that they reflect intensity of grazing in the surrounding area (Smith *et al.* 2010; 2014). Here, scarabaeid dung beetles accounted for 3% of the terrestrial assemblage in the primary fill (context 3074), a proportion that would indicate low-level or 'naturalistic' grazing in the area around the pit. The proportion in the secondary fill (context 3073) was 8% suggesting a more substantial population of grazing animals was present in the vicinity of the pit by this time (Smith *et al.* 2010; 2014). Such proportions of dung beetles do not necessarily indicate permanent pastureland. Traditionally, haymaking would be carried out in the summer with livestock being grazed on the regrown vegetation through the autumn and often into the next year, their dung, and often manuring, adding nutrients to the soil. Animals would be excluded to allow the meadow to regrow in the spring (e.g. Lowland Grass Management Handbook (2<sup>nd</sup> edn), Chapter 6). The most numerous dung beetle in the secondary fill (context 3073) was *Aphodius contaminatus* which is active from August to November (Jessop 1986, 23).

A further line of evidence that might suggest the presence of meadowland, at least close to the pit, is the abundance of Apionidae and *Sitona* weevils. Both groups were common in the analysed samples, accounting for 6% of the terrestrial fauna in the primary fill and 5% in the secondary fill, levels that have been suggested may be indicative of ungrazed grassland, with levels over 5% possibly suggesting meadowland (Robinson 2002, 26). Many species within these two groups feed on vetches, clovers and grassland trefoils and their life cycles require their host plants to achieve maturity rather than being constantly eaten to ground level. The figures should be used with caution because isolated apionid sclerites can often not be identified closely, including at the present site.

#### *Waste disposal*

Groups of decomposer beetles characteristically found in litter within ancient buildings were recorded in both analysed samples (5% of the terrestrial fauna in both samples) suggesting that limited amounts of occupation litter had regularly entered the pit, perhaps in run-off from manured ground or nearby settlement. Other taxa regarded as synanthropic to some degree mostly consisted of 'facultative synanthropes' (i.e. favoured by human activity but also common in natural situations; Kenward 1997). The insect evidence was therefore insufficient to suggest direct dumping of significant amounts of organic occupation waste into the feature.

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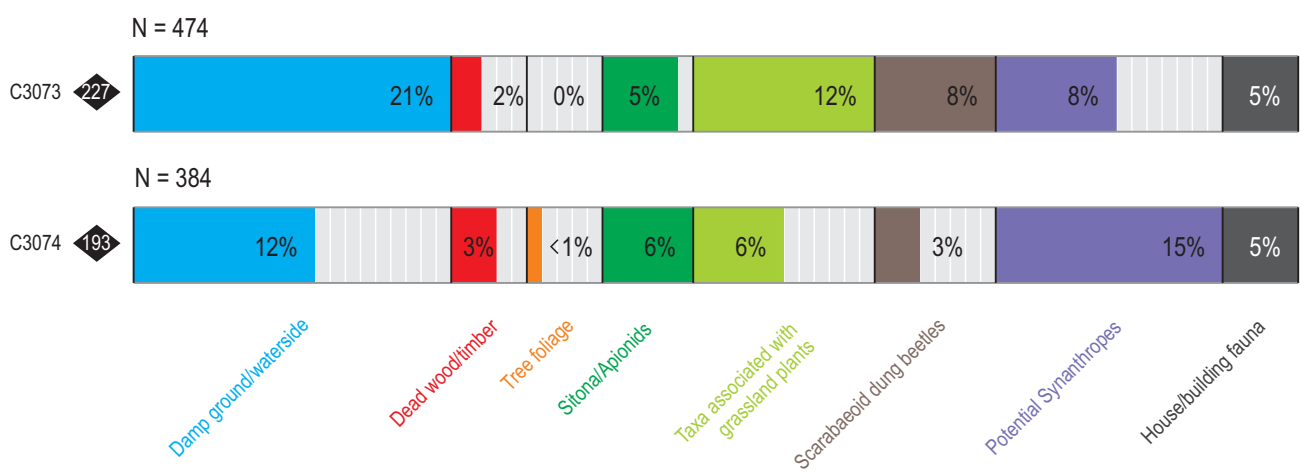


Figure 1. Proportions of terrestrial beetles & bugs representing selected ecological groups

<b>Table 2</b>					
<b>Pit [3067]: Insects and other invertebrates recorded from the samples</b>					
Ecological codes shown in square brackets are: d - damp ground/waterside, h - house/building, l - wood/timber, oa - outdoor taxa not usually found within buildings or in accumulations of decomposing matter, ob - probable outdoor taxa, p - plant-associated, sf - facultative synanthropes, ss - strong synanthropes, st - typical synanthropes, t - tree foliage, u - uncoded, w - aquatic. Abundance of insects other than adult terrestrial beetles and bugs has been estimated as + 1-3, ++ 4-10, +++ 11-50, ++++ >50. Abundance of other invertebrates has been recorded as present (P), common (C) and abundant (A)					
Context	3074	3074	3074	3074	3073
Sample	<193>	<219>	<215>	<212>	<227>
Sample volume	5L	1L	1L	1L	5L
Recording method	Analysis	Scanning	Scanning	Scanning	Analysis
<b>ANNELIDA</b>					
Oligochaeta sp. (earthworm) egg capsules	-	-	-	-	P
<b>CRUSTACEA</b>					
<i>Daphnia</i> sp. ephippia	P	-	P	-	C
Cladocera spp. ephippia	P	P	-	-	P
Ostracoda spp. carapaces	C	C	P	C	C
<b>INSECTA</b>					
<b>DERMAPTERA (earwigs)</b>					
Dermaptera sp. [u]	+	-	+	++	++
<b>HEMIPTERA: HETEROPTERA (true bugs)</b>					
<b>Coreidae (shield bugs)</b>					
<i>Coreus marginatus</i> (Linnaeus) [oa-p]	1	-	-	-	1
? <i>Coreus marginatus</i> (Linnaeus) nymph [oa-p]	-	-	-	-	+
<b>Pentatomidae (shield bugs)</b>					
<i>Podops inuncta</i> (Fabricius) [oa-p]	-	-	-	-	3
<b>Berytidae (stilt bugs)</b>					
<i>Gampsocoris punctipes</i> (Germar) [oa-p]	-	-	-	-	1
<i>Berytinus</i> sp. [oa-p]	-	-	-	-	2
Berytidae sp. [oa-p]	-	-	-	-	1
<b>Lygaeidae (ground bugs)</b>					
<i>Drymus</i> sp. [oa-p]	-	-	-	-	4
<i>Heterogaster urticae</i> (Fabricius) [oa-p]	-	-	-	+	-
<i>Scolopostethus</i> sp. [oa-p]	2	-	-	-	-
<i>Stygnocoris</i> sp. [oa-p]	1	-	-	-	-
Lygaeidae spp. [oa-p]	-	+	-	-	1
<b>Miridae</b>					
Miridae sp. [u]	3	-	-	-	-
<b>Tingidae (lace bugs)</b>					
Tingidae sp. [u]	2	-	-	-	-
<b>Corixidae (water boatmen)</b>					
Corixidae spp. [oa-w]	++	-	-	-	+
?Corixidae sp(p). nymphs [oa-w]	+	+	-	-	+
<b>Gerridae (skaters)</b>					
<i>Gerris</i> sp(p). [oa-w]	+	-	-	-	+
<b>Hebridae</b>					
<i>Hebrus</i> sp. [oa-p-d]	-	-	-	-	+
<b>Saldidae (shore bugs)</b>					

Saldidae sp(p). [oa-d]	3	+	+	-	3
Heteroptera spp. (water bug) [oa-w]	+	-	-	+	+
Heteroptera sp. [u]	1	-	-	-	-
HEMIPTERA: HOMOPTERA					
Cicadellidae (planthoppers)					
<i>Megophthalmus</i> sp. [oa-p]	-	-	-	-	3
<i>Anoscopus</i> sp. [oa-p]	-	-	-	-	6
Delphacidae (leafhoppers)					
<i>Conomelus anceps</i> Germar [oa-p]	1	-	-	-	8
Delphacidae spp. [oa-p]	11	+	-	++	7
Auchenorrhyncha spp. [oa-p]	11	+	+	++	15
Psylloidea (jumping plant lice)					
<i>Livia junci</i> (Schrank) [oa-p]	-	-	-	-	3
<i>Trioza urticae</i> (Linnaeus) nymphal skins [oa-p]	++	-	-	+	+
Psylloidea sp. indet. [oa-p]	1	-	-	-	-
Psylloidea sp. indet. nymph [oa-p]	-	-	-	-	+
Aphidoidea sp. (aphids)	+	-	-	-	+
Coccoidea (Diaspididinae) sp. (scale insects)	+	-	-	-	-
COLEOPTERA (beetles)					
Gyrinidae (whirligig beetles)					
<i>Gyrinus</i> sp. [oa-w]	-	+	-	-	-
Haliplidae (crawling water beetles)					
<i>Haliphys lineatocollis</i> (Marsham) [oa-w]	+	-	-	-	+
<i>Haliphys</i> sp. [oa-w]	+	+	+	+	++
Noteridae (burrowing water beetles)					
<i>Noterus</i> sp. [oa-w]	-	-	-	-	+
Dytiscidae (diving beetles)					
<i>Agabus bipustulatus</i> (Linnaeus) [oa-w]	++	-	+	+	+
<i>Agabus nebulosus</i> (Forster) [oa-w]	-	+	-	-	+
<i>Agabus</i> or <i>Ilybius</i> spp. [oa-w]	+	+	-	+	+
<i>Colymbetes fuscus</i> (Linnaeus) [oa-w]	++	+	+	+	+
<i>Graptodytes pictus</i> (Fabricius) [oa-w]	+	-	-	-	+
<i>Hydroporus palustris</i> (Linnaeus) [oa-w]	+	+	+	-	+
<i>Hydroporus</i> sp. [oa-w]	-	-	-	-	+
<i>Hygrotus confluens</i> (Fabricius) [oa-w]	-	-	-	-	+
<i>Hygrotus inaequalis</i> (Fabricius) [oa-w]	++	-	-	-	++
<i>Hygrotus impressopunctatus</i> (Schaller) [oa-w]	-	+	-	-	-
Hydroporinae spp. [oa-w]	+++	++	+	++	+++
Dytiscidae spp. [oa-w]	-	+	-	-	+
Carabidae (ground beetles)					
<i>Brachinus crepitans</i> (Linnaeus) [oa]	1	-	-	-	-
<i>Nebria brevicollis</i> (Fabricius) [oa]	1	-	+	-	-
<i>Nebria</i> cf <i>brevicollis</i> (Fabricius) [oa]	-	-	-	-	1
<i>Notiophilus</i> sp. [oa]	1	-	-	-	1
<i>Loricera pilicornis</i> (Fabricius) [oa]	-	-	-	-	1
<i>Clivina</i> sp. [oa]	1	+	-	-	-
<i>Trechus obtusus</i> or <i>quadristriatus</i> [oa]	2	-	+	+	-
<i>Trechus</i> sp. indet. [oa]	-	-	-	-	1
<i>Bembidion</i> ( <i>Phyla</i> ) <i>obtusum</i> Audinet-Serville [oa]	-	-	+	-	1
<i>Bembidion</i> ( <i>Philochthus</i> ) <i>guttula</i> or <i>mannerheimi</i> [oa]	1	-	-	-	-

<i>Bembidion (Philochthus) lunulatum</i> (Geoffroy in Four.)	11	+	-	-	5
<i>Bembidion (Philochthus) ?lunulatum</i> (Geoffroy in Four.)	-	-	+	-	-
<i>Bembidion</i> spp. and sp. undifferentiated [oa]	-	+	+	+	3
<i>Stomis pumicatus</i> (Panzer) [oa]	1	-	-	-	-
<i>Poecilus cf cupreus</i> (Linnaeus) [oa]	1	-	-	-	-
<i>Pterostichus melanarius</i> (Illiger) [ob]	2	-	-	-	2
<i>Pterostichus</i> sp. [oa]	1	-	-	-	-
<i>Calathus fuscipes</i> (Goeze) [oa]	2	-	-	-	2
<i>Calathus melanocephalus</i> (Linnaeus) [oa]	-	-	-	-	1
<i>Anchomenus dorsalis</i> (Pontoppidan) [oa]	1	-	-	+	2
<i>Agonum</i> spp. [oa]	2	-	-	-	-
<i>Amara</i> spp. [oa]	2	-	-	+	1
<i>Harpalus rufipes</i> (De Geer) [oa]	1	-	-	+	-
<i>Ophonus ardiosiacus</i> (Lutschnik) [oa]	3	-	-	-	-
<i>Ophonus</i> spp. [oa]	3	-	-	+	1
? <i>Badister</i> sp. [oa]	-	-	-	+	-
<i>Paradromius linearis</i> (Olivier) [oa]	2	-	-	+	-
<i>Microlestes</i> or <i>Syntomus</i> sp. [oa]	2	-	-	-	-
Carabidae spp. [ob]	-	++	++	++	5
Helophoridae (grooved water scavengers)					
<i>Helophorus aequalis</i> Thomson [oa-w]	++	-	-	-	++
<i>Helophorus grandis</i> Illiger [oa-w]	++	+	-	+	+++
<i>Helophorus aequalis</i> or <i>grandis</i> [oa-w]	+++	++	++	++	++
<i>Helophorus</i> spp. [oa-w]	++++	+++	+++	+++	++++
Hydrophilidae					
<i>Anacaena globulus</i> (Paykull) [oa-w]	++	-	-	-	-
<i>Anacaena</i> sp(p). [oa-w]	+	+	+	+	+++
<i>Berosus</i> sp. [oa-w]	-	-	-	-	+
? <i>Chaetarthria</i> sp. [oa-d]	-	-	-	-	1
<i>Enochrus</i> sp. [oa-w]	+	-	-	-	-
<i>Helochares lividus</i> (Forster) [oa-w]	-	-	-	-	++
<i>Hydrobius fuscipes</i> (Linnaeus) [oa-w]	++	++	+	++	+++
<i>Laccobius</i> sp. [oa-w]	+	-	-	-	+
Hydrophilinae spp. [oa-w]	-	+	-	+	++
<i>Coelostoma orbiculare</i> (Fabricius) [oa-w]	-	-	-	-	+
<i>Cercyon ustulatus</i> (Preyssler) [oa-d]	1	-	-	-	-
<i>Cercyon haemorrhoidalis</i> (Fabricius) [rf-sf]	1	-	-	-	2
<i>Cercyon impressus</i> (Sturm) [rf-sf]	-	-	-	-	1
<i>Cercyon nigriceps</i> (Marsham) [rf-st]	1	-	-	-	-
<i>Cercyon ?terminatus</i> (Marsham) [rf-st]	1	-	-	-	-
<i>Cercyon tristis</i> (Illiger) [oa-d]	-	-	-	-	1
<i>Cercyon ?tristis</i> (Illiger) [oa-d]	-	-	-	-	2
<i>Cercyon</i> spp. and sp. indet. [u]	2	+	-	+	-
<i>Megasternum concinnum</i> (Marsham) [rt]	7	+	+	+	14
<i>Cryptopleurum minutum</i> (Fabricius) [rf-st]	-	-	-	-	2
<i>Sphaeridium</i> sp. [rf]	1	-	-	-	-
Histeridae (clown beetles)					
<i>Acritus nigricornis</i> (Hoffman) [rt-st]	1	-	-	-	-
Hydraenidae					
<i>Hydraena testacea</i> Curtis [oa-w]	+	-	-	++	+

<i>Hydraena</i> spp. [oa-w]	+++	+	-	+	++
<i>Limnebius</i> spp. [oa-w]	++++	++	++	+++	++++
<i>Ochthebius bicolon</i> Germar [oa-w]	+	-	-	+	+
<i>Ochthebius dilatatus</i> Stephens [oa-w]	+++	+	+	-	++
<i>Ochthebius minimus</i> (Fabricius) [oa-w]	++++	++	-	+++	+++
<i>Ochthebius</i> c.f. <i>minimus</i> [oa-w]	-	-	++	-	-
Ptiliidae (featherwing beetles)					
<i>Ptenidium</i> sp. [rt]	2	-	-	-	1
<i>Acrotrichis</i> sp. [rt]	1	-	-	-	2
Leiodidae					
Cholevinae sp. [u]	3	+	+	-	-
Staphylinidae (rove beetles)					
<i>Lesteva longoelytrata</i> (Goeze) [oa-d]	9	+	-	+	5
<i>Omalius rivulare</i> (Paykull) [rt-sf]	1	-	-	-	-
<i>Omalius</i> sp. [rt]	1	-	-	-	-
Omaliinae sp. [u]	-	-	-	-	2
<i>Metopsia clypeata</i> (Müller) [rt]	1	+	-	-	1
<i>Micropeplus</i> sp. [rt]	1	-	-	-	-
Pselaphinae spp. [u]	1	-	-	+	-
Mycetoporini sp. [u]	1	-	-	-	-
<i>Sepedophilus</i> sp. [u]	1	-	-	-	-
<i>Tachinus rufipes</i> (Linnaeus) [u]	2	-	-	-	2
<i>Tachinus laticollis</i> or <i>marginellus</i> [u]	2	-	-	-	-
<i>Tachinus</i> sp. not differentiated [u]	-	-	+	+	-
<i>Tachyporus</i> spp. [u]	8	+	+	+	12
<i>Cordalia obscura</i> (Gravenhorst) [rt-sf]	1	-	-	-	-
<i>Falagria</i> sp. [rt-sf]	1	-	-	-	-
<i>Cypha</i> sp. [u]	2	-	-	-	1
<i>Drusilla canaliculata</i> (Fabricius) [rt]	2	-	+	+	1
<i>Crataraea suturalis</i> (Mannerheim) [rt-st-h]	2	-	-	-	-
Aleochariinae spp. [u]	21	++	++	++	13
<i>Anotylus complanatus</i> (Erichson) [rt-sf]	1	-	-	-	-
<i>Anotylus nitidulus</i> (Gravenhorst) [rt-d]	4	+	-	-	3
<i>Anotylus rugosus</i> (Fabricius) [rt]	4	+	+	-	5
<i>Anotylus sculpturatus</i> group [rt]	1	-	-	-	6
<i>Anotylus</i> sp. undifferentiated [rt]	-	-	+	-	-
<i>Platystethus cornutus</i> group [oa-d]	4	+	-	+	8
<i>Platystethus nitens</i> (Sahlberg) [oa-d]	2	-	-	-	3
<i>Platystethus ?nodifrons</i> Mannerheim [oa-d]	-	-	-	-	1
<i>Platystethus arenarius</i> (Fourcroy) [rf]	3	-	+	+	2
<i>Carpelimus ?bilineatus</i> or <i>?erichsonii</i> [rt-sf]	7	-	-	-	4
<i>Carpelimus</i> spp. and spp. undifferentiated [u]	5	+	+	+	2
Scydmaeninae spp. [u]	1	-	-	-	1
<i>Stenus</i> spp. [u]	3	-	-	-	10
<i>Astenus</i> sp. [rt]	-	+	-	-	1
<i>Lathrobium</i> spp. [u]	2	-	-	-	1
<i>Rugilus</i> sp. [rt]	1	-	+	-	1
Paederinae sp. [u]	3	+	-	-	-
<i>Gabrius</i> sp. [rt]	2	-	-	-	2
<i>Gyrophypnus angustatus</i> Stephens [rt-st]	-	-	-	-	1

<i>Gyrophypnus fracticornis</i> (Müller) [rt-st]	2	-	-	-	-
<i>Gyrophypnus</i> sp. [rt]	-	+	-	-	-
<i>Leptacinus pusillus</i> (Stephens) [rt-st]	2	-	-	-	-
<i>Megalinus glabratus</i> (Gravenhorst) [rt]	1	-	-	-	-
<i>Xantholinus gallicus/linearis/longiventris</i> [rt-sf]	3	-	+	+	6
Xantholinini sp. [u] (large)	-	-	-	-	1
Staphylininae spp. [u]	7	++	+	+	13
Geotrupidae (dor beetles)					
Geotrupinae sp. [oa-rf]	-	-	+	-	-
Lucanidae (stag beetles)					
<i>Sinodendron cylindricum</i> (Linnaeus) [l]	-	-	-	-	1
Scarabaeidae (dung beetles and chafers)					
<i>Aphodius ater</i> (De Geer) [oa-rf]	-	-	-	-	1
<i>Aphodius fimetarius</i> (Linnaeus) [ob-rf]	2	-	-	-	-
<i>Aphodius erraticus</i> (Linnaeus) [oa-rf]	1	-	-	-	1
<i>Aphodius prodromus</i> or <i>sphacelatus</i> [ob-rf]	3	+	-	+	11
<i>Aphodius contaminatus</i> (Herbst) [oa-rf]	2	++	-	+	21
<i>Aphodius</i> spp. and sp. indet. [ob-rf]	2	-	-	-	1
<i>Onthophagus ?joannae</i> Goljan [oa-rf]	-	-	-	-	2
<i>Phyllopertha horticola</i> (Linnaeus) [oa-p]	1	-	-	-	-
? <i>Phyllopertha horticola</i> (Linnaeus) [oa-p]	-	-	-	-	1
Scirtidae (marsh beetles)					
<i>Cyphon</i> sp(p). [oa-d]	7	-	-	++	51
Byrrhidae (pill beetles)					
<i>Byrrhus</i> sp. [oa]	1	-	-	-	-
Byrrhidae sp. [u]	-	-	-	-	1
Elmidae (riffle beetles)					
<i>Elmis aenea</i> (Müller) [oa-w]	+	-	-	-	-
<i>Normandia</i> or <i>Riolus</i> sp. [oa-w]	+	-	-	-	-
<i>Oulimnius</i> sp. [oa-w]	++	+	-	-	+
Dryopidae (long-toed water beetles)					
<i>Dryops</i> sp. [oa-d]	2	+	-	-	3
Heteroceridae (mud beetles)					
<i>Heterocerus</i> sp. [oa-d]	1	-	-	-	2
Elateridae (click beetles)					
<i>Agrypnus murinus</i> (Linnaeus) [oa-p]	-	-	-	-	4
<i>Athous</i> sp. [oa-p]	1	-	-	-	1
<i>Agriotes</i> spp. [oa-p]	-	-	-	-	19
Elateridae spp. and sp. not differentiated [ob]	5	+	+	+	-
Elateridae sp. (larval apices) [ob]	-	-	-	++	-
Cantharidae (soldier beetles)					
<i>Cantharis rustica</i> Fallén [oa]	1	+	-	-	3
<i>Rhagonycha fulva</i> (Scopoli) [oa]	3	-	-	-	2
Cantharidae spp. [ob]	3	-	+	+	6
Ptinidae (spider and woodworm beetles)					
<i>Ptinus fur</i> (Linnaeus) [rd-sf-h]	-	-	-	-	2
Ptininae sp. [rd]	2	-	-	-	-
<i>Anobium punctatum</i> (De Geer) [l-sf]	7	-	+	+	-
<i>Anobium ?punctatum</i> (De Geer) [l-sf]	-	-	-	-	4
Kateretidae (short-winged flower beetles)					

<i>Brachypterus</i> sp. [oa-p]	1	+	-	-	1
Nitidulidae (sap and pollen beetles)					
Nitidulidae sp. [u]	-	-	-	-	1
Monotomidae					
<i>Monotoma picipes</i> Herbst [rt-st]	2	-	-	-	-
<i>Monotoma</i> sp. indeterminate [rt-sf]	-	-	-	+	-
Phalacridae					
Phalacridae sp. [oa-p]	-	-	-	-	1
Cryptophagidae (silken fungus beetles)					
<i>Cryptophagus</i> spp. [rd-sf-h]	2	+	-	-	1
<i>Atomaria</i> spp. [rd-sf-h]	-	+	-	++	6
<i>Ephistemus globulus</i> (Paykull) [rd-sf-h]	1	-	-	-	1
Coccinellidae (ladybirds)					
<i>Coccidula rufa</i> (Herbst) [oa]	-	-	-	+	3
Coccinellidae sp. [oa]	1	-	-	-	1
Corylophidae					
<i>Orthoperus</i> spp. [rt]	3	-	-	+	-
Corylophidae sp. [rt]	3	-	-	+	1
Latridiidae (minute brown scavenger beetles)					
<i>Latridius minutus</i> group [rd-st-h]	6	-	+	-	7
<i>Enicmus</i> sp. [rd-sf-h]	5	+	+	+	7
<i>Corticaria punctulata</i> Marsham [rt-sf]	2	-	-	-	-
<i>Corticaria</i> spp. [rt-sf]	7	-	-	-	-
Corticariinae spp. [rt]	15	+	-	+	7
Mycetophagidae (hairy fungus beetles)					
<i>Typhaea stercorea</i> (Linnaeus) [rd-ss-h]	1	-	-	-	-
Colydiidae					
<i>Bitoma crenata</i> (Fabricius) [l]	1	-	-	-	-
Anthicidae (ant-like flower beetles)					
<i>Omonadus</i> sp. [rt]	1	-	-	-	-
Scraptidae (false flower beetles)					
Scraptidae spp. [u]	2	-	-	-	-
Chrysomelidae (seed and leaf beetles)					
Bruchinae sp. [u]	1	-	-	-	-
<i>Hydrothassa</i> sp. [oa-p]	-	-	-	+	-
<i>Prasocuris phellandrii</i> (Linnaeus) [oa-p-d]	3	-	-	+	6
<i>Phyllotreta nemorum</i> group [oa-p]	3	-	-	-	5
<i>Phyllotreta</i> sp. [oa-p]	1	-	-	-	-
<i>Longitarsus</i> sp(p). [oa-p]	11	+	-	++	8
<i>Altica</i> sp. [oa-p]	1	+	-	+	-
<i>Neocrepidodera ferruginea</i> (Scopoli) [oa-p]	-	-	-	-	6
<i>Neocrepidodera ?transversa</i> (Marsham) [oa-p]	-	-	-	-	2
<i>Chaetocnema concinna</i> or <i>picipes</i> [oa-p]	2	+	-	-	-
<i>Sphaeroderma</i> sp. [oa-p]	-	-	+	-	2
<i>Psylliodes</i> sp. [oa-p]	2	-	+	-	-
Chrysomelidae sp. [oa-p]	1	+	-	+	-
Apionidae					
<i>Apion</i> sp. [oa-p]	-	-	-	-	1
<i>Ceratapion carduorum</i> Kirby [oa-p]	2	+	-	-	-
<i>Malvapion malvae</i> (Fabricius) [oa-p]	1	-	-	-	-

<i>Oxystoma</i> sp. [oa-p]	-	-	-	-	2
Apionidae spp. and sp. indet. [oa-p]	16	++	+	++	14
Eirrhinidae (wetland weevils)					
<i>Tanysphyrus lemnae</i> (Paykull) [oa-p-w]	+	-	-	+	+
Curculionidae (weevils)					
<i>Mecinus labilis</i> (Herbst) [oa-p]	2	-	+	-	-
<i>Mecinus pascuorum</i> (Gyllenhal) [oa-p]	1	-	-	+	-
<i>Mecinus ?pascuorum</i> (Gyllenhal) [oa-p]	-	-	-	-	2
<i>Mecinus pyraster</i> (Herbst) [oa-p]	-	-	-	+	-
<i>Tychius</i> sp. [oa-p]	-	-	-	-	1
<i>Orchestes</i> sp. (Linnaeus) [oa-p-t]	1	-	-	-	-
<i>Ramphus</i> sp. [oa-p-t]	3	-	-	-	-
<i>Ceutorhynchus erysimi</i> (Fabricius) [oa-p]	1	-	-	-	-
<i>Ceutorhynchus</i> spp. [oa-p]	3	+	-	-	4
<i>Rhinoncus ?pericarpus</i> (Linnaeus) [oa-p]	1	-	-	-	-
Ceutorhynchinae spp. [oa-p]	4	-	-	-	7
<i>Graptus triguttatus</i> (Fabricius) [oa-p]	-	-	-	-	1
<i>Phyllobius</i> or <i>Polydrusus</i> sp. [oa-p]	-	-	-	-	4
<i>Sitona</i> spp. [oa-p]	5	-	-	+	7
<i>Hypera</i> sp. [oa-p]	-	-	-	-	1
<i>Scolytus</i> sp. [1]	1	-	-	-	-
Scolytinae spp. [1]	1	-	-	-	4
Curculionidae spp. and sp. indeterminate [oa-p]	4	++	+	-	4
DIPTERA (flies)					
Bibionidae sp. leg spines	+	-	-	+	-
Chironomidae sp(p) larval head capsules	-	+	-	-	+
Diptera spp. adults	-	-	-	+	+
Diptera spp. puparia	+	+	+	++	-
HYMENOPTERA (bees, wasps and ants)					
Formicidae spp. (ants)	++	+	-	+++	+
Apoidea spp. (bees, but not honey bee)	+	-	+	-	+
Hymenoptera Parasitica spp. (parasitic wasps)	+++	+	+	++	++
TRICHOPTERA (caddis flies)					
Trichoptera sp. wing fragments	-	-	-	+	+
Trichoptera sp. larval head fragments	++	+	-	-	+
Insecta spp. indet. larval fragments	-	-	-	-	+++
<b>ARACHNIDA</b>					
Acarina spp. (mites)	A	C	C	C	C
Aranae sp. (spiders)	P	-	-	-	-
TOTAL ADULT TERRESTRIAL BEETLES AND BUGS	382	75	75	75	474
ESTIMATED ADULT AQUATIC BEETLES AND BUGS	400+	75+	75+	75+	500+