Studies of recently dead insects to understand insect remains in archaeological deposits

MAGNUS HELLQVIST

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Today it becomes more and more common during archaeological investigations to use insect analyses when interpreting the natural and cultural environment during prehistoric and historic times. The composition and amount of insects in the deposits is dependent on both what insect species that is deposited and the preservation of the remains. It is therefore important to understand how different insects are preserved in archaeological deposits. Results are presented from analyses of recently dead insect remains in two wells and a stable floor, in south central Sweden. These data where compared with the results from Iron Age deposits. These data yield clues regarding the deposition of insect remains in prehistoric rural sites. It is concluded that ground-dwelling insects dominate records from wells and beetles enter the well accidentally and drown. Because of the absence of beetles associated with substrates like dung and wood in the modern deposits, in opposite to prehistoric, it is concluded that these groups of beetle species probably either are present around an uncovered well or are secondarily deposited through dumped material if the well head is covered and enclosed. The indoor environment of a stable is characterized through more remnants of insect species from the local human environment and wood, but also incorporates species randomly trapped during local flight.

Magnus Hellqvist, Högskolan Dalarna, Naturgeografi, Campus Lugnet, 791 88 Falun. E-post: mhq@du.se

Introduction

During an archaeological excavation the archaeologist aim is to describe the history of the site. In order to get as broad and detailed picture as possible of a site, a number of special methods are used to improve the interpretation, like analysis of remnants of insects and plant material. The study of macroscopic remains of insects, particularly beetles, has shown to be one of the most suitable methods in understanding the environmental history of a settlement, both the environment inside the house, within the settlement and in the natural surroundings. An obscuring factor, however, is that the degree to which insects are preserved to modern time, varies.

Authors use descriptions of the insect remnants very differently and the term fossil is commonly used about all kinds of insect's remnants, even when it is not fossil in the sense of the term's definition. The study of insect remains in sediments is very different from insect fossils in bedrock, but they are both methodically within the discipline *palaeoentomology*. Sometime authors use other method names to point to their special working field, *e.g.* Arkeo-entomology, meaning remains of insects in archaeological deposits.

The studies of insects remains from sediments in geological as well as archaeological investigations has a long tradition, also in the Nordic countries. The older works in the field are dating back to late 19th and early 20th century. The first Swedish findings of insect remains were collected directly from open sections in peat deposits presented by for example Andersson (1889). They considered these remains of specimens to be extinct species. This was later proved to be wrong by authors like Henriksen (1933) and Lindroth (1948). The method was later developed and established by G. R. Coope and colleagues at the University of Birmingham (*e.g.* Coope 1961; Coope *et al*. 1961) and the establishment of the method in Sweden advanced especially through work by Lemdahl (*e.g.* 1988a).

More frequent studies of insect remains in archaeological deposits started in the late 1960´s with studies like Osborne (1969), Buckland (1973a, 1973b and 1974) and Buckland et al. (1974) and has since then increased. In Sweden early work about insect remains in archeological deposits increased during the 1980:s through work by Lemdahl (*e.g.* 1982, 1988b) and also Andersson (*e.g*. 1985a, 1985b, 1986). It has most actively been used in Britain, while rather few studies have been made until today in Sweden. This must be improved since it is important for each country to develop its own collection of studies, to get reliable comparisons between investigations as each country has unique natural and cultural development.

To make good interpretations from studies of insect remains it is essential to understand what has happened to the insect remains from the day it was alive until it is found as remnant in the sediment (Smith 1996). The study of the history of any organism from living state to remnants or fossils is named *taphonomy*. Present knowledge is derived from different controlled studies on past and present insects, especially from Great Britain (e.g. Buckland *et al*. 1995; Kenward 1975, 1978, 1982; Smith 1996). In Sweden there are less investigations although. Andersson and Larsson (1992a, 1992b & 1992c) made pioneer studies in the southwest part of Sweden, studying samples from a remnant of a farm and from the surrounding natural environment.

The best way to improve the interpretation of insects deposited in sediments, is to take samples of sediments with recently dead insect remains, in an environment with known history (Smith 1996). Studies of *taphonomical* problems in archaeological deposits may be broadly separated into studies of urban and rural settings. This paper represent such study in a rural setting, using sediment samples of modern insects remnants from a Swedish farm settlement, where the land-use history during the last few decades is known. The aim of this study was to compare depositions in recent and sub recent environments in rural settlements with samples from rural settlements from Iron Age. Another aim is to understand more about how different kinds of insects get deposited in the human settlement and by this also how well this corresponds to the surrounding environment and conditions.

Site descriptions

The study area is at Myrkarby farm (Fig. 1), situated at about 55 m.a.s.l., *c* 15 km east of the town Sala, in the province of Västmanland, south-central Sweden. Samples from Well I and Stable are from here. Well II was at a house 3 km W of the farm. The study area is situated within the Hemiboreal zone, characterized by mixed broad-leaved deciduous and coniferous forests (Ahti *et al*. 1968). The mean temperatures are 17°C during July and -4°C during January, with mean annual precipitation of 550 mm.

The data collected at the modern farm were compared with an earlier investigation of three Iron Age farm wells (Hellqvist 1999), from the same region (Västmanland). The sampled Iron Age sites, Vallby 6 km NE of town Västerås (well III in Fig. 2, 3 & 4) and Lundbacken 22 km ENE of town Enköping (well IV & V in Fig. 2, 3 & 4), are situated about 25-30 km south to southwest of the modern farm. During archaeological excavations, three wells was sampled for analysis of insect remains. The wells are situated within a rural situation of two prehistoric farm settlements.

The soil characteristics are typical for areas around Mälardalen valley in south central Sweden, with a landscape with broader valleys of clay and gyttja clay and with a stream in the central part. The surrounding hills are dominated by till and bedrock outcrop. Both the modern and prehistoric settlements are situated in the transition between the till areas dominated by coniferous forest and the cultivated areas dominated by clay. The whole area is generally well drained.

It is of course impossible to find similar environments today as during Iron Age. The choice of modern analogue to the prehistoric farm must be as close as possible. It is also important to have control of activities or events that may have affected the modern deposit of insects remnants. Modern ways of cultivation, varied type of grazing animals, the use of pesticides and events like fire occasions at the farm are some of the factors that must be known to get satisfying control of the modern composition of insect remnants. Similarly, to get good modern analogue to the prehistoric farm environment, it is important with a varying and diverse landscape from cultivated fields, grazed areas and medium to old forest. These factors was well fulfilled at the farm used in the investigation presented here. The closely situated house well was mainly chosen as reference to the farm well.

Farm well (Well I) and stable floor

Samples for insect analysis were collected from a farm well (Well I, volume 210 dm^3, wet residue) and under wood flooring in a stable (volume 68 dm^3, dry residue). Well I is about 2.5 m deep and with a stone wall structure. The well opening has always been covered. It is situated in the middle of the farm in a small yard with grass vegetation, occasionally used for grazing for a long time period.

About 200 meters east of the settlement there is a small stream (Fig. 1). Pesticides and fertilizers have been used and is partly still used, but in small portions. Manure have been and is still used on cultivated fields. The farm settlement is surrounded by arable fields and grazing land. The cultivated fields rotate continuously between cultivation, grazing and fallow field. To the west of the settlement there is an old coniferous forest, dominated by spruce (*Picea abies*) and pine (*Pinus sylvestris*). This stand is a nature reserve because the old age of the forest. A barn is situated at the west side of the farm settlement. It is used for sheltering cattle and sheep and storing hay, straw and cereals.

The stable (Stable, S, Fig. 1) is east of the barn. It is built of timber, with tiled roof and is one of the older buildings on the farm. The structural timber is attacked by common furniture beetle (*Anobium punctatum*). Both cattle and horses have been stabled on the bottom floor, although horses have dominated during the last few decades. The upper floor is used for storing hay and straw. Insects may easily get in to the stable from the outside.

By the gable of the barn there are manure heaps with predominantly cow dung. By the stable there are occasionally two manure heaps containing mainly horse dung. The manure is continuously utilised and replenished. There is recurrent transport of hay, cereals and timber within the settlement.

The house well (Well II)

The house well (well II) is situated 3 km west of Myrkarby. The surroundings are dominated by large open undulating areas of intensively used arable land, continuously rotating between cultivation and fallow field. There are no grazing animals in the vicinity. 75 m north there is a coniferous forest area dominated by spruce (*Picea abies*) and pine (*Pinus sylvestris*). There is also a small river *c* 500 m south-west of the site. One sample was collected (volume 720 dm^3, wet residue) for insect analysis from the bottom of Well II about 2.5 m below ground surface. The well has a stone wall structure and the well head has always been well covered. It is situated between two wooden buildings and is exposed to the south.

The Iron Age wells (Well III-V)

The excavated area at Vallby (well III) consisted of 12 houses, dated from the late Roman Iron Age to the Migration Period (200-550 AD). The well was situated under the youngest of the house constructions, and is by this given a *terminus post quem*, since it must have been filled in before the construction of the house. The well construction was about 3 m in diameter, about 3.58 m deep and funnel-shaped. It is constructed of wickerwork of birch stems and stone packing at the bottom.

The excavated settlement area at Lundbacken (well IV & V) consisted of 3 houses. The wells were situated close to the west and east sides of the oldest house dated to the 3rd century AD (Roman Iron Age), but the interpretation was that they were not contemporary with the house. Well IV is interpreted as belonging to a house from the late Roman Iron Age and the Migration Period (200-550 AD) and the well construction was about 2.40 m in diameter and about 2.60 m deep and funnel-shaped. The deposits were accumulated on several occasions. The bottom part of well IV was built of wooden planks and logs in a rectangular construction along the walls and with a big stone in the middle. The site is situated *c* 200 m from a small stream. Well V seems to be connected with a house, which is dated to the Roman Iron Age (0-400 AD) and the well construction was about 4.40 m in diameter and 2.82 m deep with a funnel-shaped form and like wells III and IV, it consisted of several accumulation layers. From the interpretation of insects remains together with pollen analysis, the surrounding of the farms were found to be a diverse cultural landscape including pastures, cultivated fields and forest areas

Material and methods

The farm and house well (Well I & II) were sampled with an Ekman grab sampler (Håkansson & Jansson 1983), whereas the stable floor was sampled directly from undisturbed stable litter under floor boards. The samples was dispersed in 10% sodium hydroxide solution and then washed through a 0.25 mm sieve. Macroscopic remains of insects were sorted out from the sieved residue under a binocular microscope at low magnification. Identification of the remains was carried out by using keys for modern specimens and by comparison with modern specimens from reference collections.

The following literature has primarily been used as help during identification and information concerning the insects present geographical distribution and biology; Backlund (1945), Booth

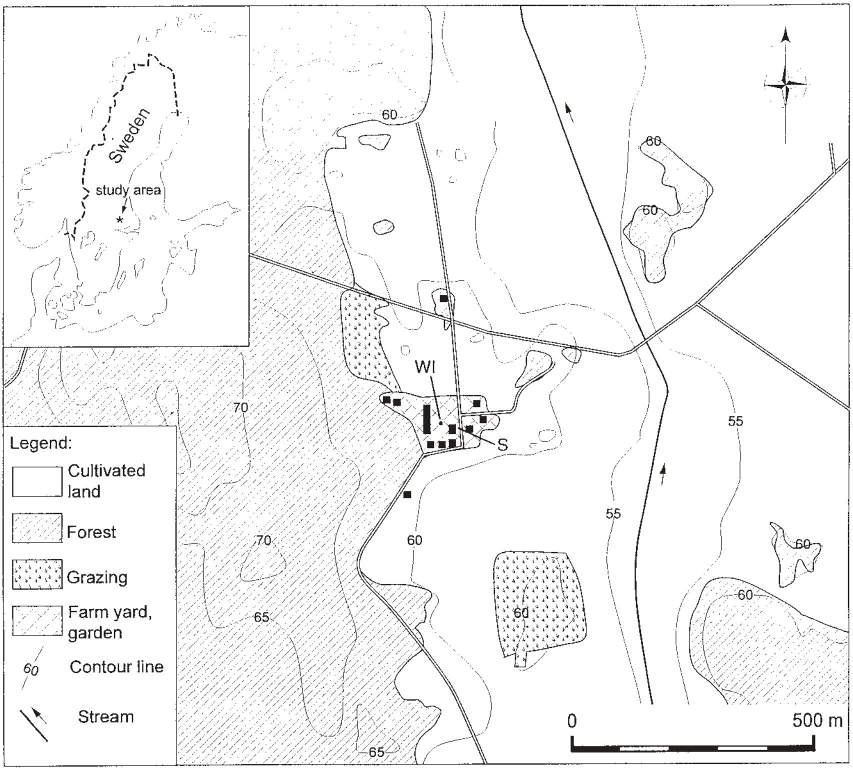

Figure 1. Location of the studied modern farm in Västmanland, south central Sweden. With the position of the sampled well (WI) and the stable building (S).

Områdeskarta over den nutida lantgården Myrkarby, Vittinge socken, Västmanland. Utmärkt på kartan är dels lantgårdsbrunnen (WI) och det gamla stallet (S).

(1988), Hansen (1987), Landin (1957, 1970), Lekander *et al.* (1977), Lindroth (1985, 1986), Lundberg (1995), T. Palm (1951, 1959), E. Palm (1996), Skidmore (1991).

In order to reconstruct the contemporary environment each beetle species was assigned to certain habitat groups. The habitat groups generally falls within three larger groups. First the degree of moisture in an area or how close it is to water. Secondly the surrounding landscape and farm economy by information on openness, grazing, cultivation and forest etc. Thirdly, the different kind of substrates created by activity or similar, especially within the settlement and indoor environment. The habitat groups, used in figures 2, 3 & 4, are defined as follows:

Water margins; margins to rivers and lakes or other kind of open water.

Hygrophilous; moist habitats around rivers and lakes, moist parts of fens or mosses, as well as moist places within the human settlements.

Xerophilous; dry habitats, usually impediments, but also dry areas within the settlement area like open activity places without vegetation.

Open landscape; generally an open country environment, without any specificity of land use, but it usually represents grazing areas.

Cultivated fields; indications of cultivated fields and agricultural activity (not grazing), but seldom with information on type of agricultural activity.

Forest; a general sense. In exceptional cases there is information on tree types.

Dung/manure; dung both in the fresh form and as manure heaps. Sometimes with an indication of the kind of dung producing animal. The dung indication may be important complement to the group 'Open landscape' by indications of grazing.

Decaying organic matter; different types of decaying substrates like leaf litter, compost or other kind of organic matter, like the organic substrates left as residue along river margins.

Timber/wood; in difference to the group ’Forest’, this refers to the wood substrate like construction material in buildings, logs and other timber material. In some cases there is indications of tree species and therefore a possible complement to the ’Forest’ group.

Synanthropy; insects associated with human environments and substrates, *e.g.* pests in stored products, wood boring insects attacking buildings, insects living indoor etc.

Results and discussion

A total of 70 insect taxa were recorded from the farm environment and 12 insect taxa from the house well (Tab. 1). The insect assemblages include taxa of bugs (Heteroptera), ants, wasps, bees and their relatives (Hymenoptera) and beetles (Coleoptera). Remains of beetles and ants were most abundant. In the wells from the Iron Age settlements, there was a total of 57 insect taxa identified from well III and 68 taxa from well IV and V and beetles were the dominating group of insects.

The sample from Well I presents a relatively diverse fauna, with well-preserved specimens. In contrast, Well II was rather poor in insect remains, despite the large sample volume. The differences in composition of the two assemblages are probably mainly due to the environment immediately surrounding the wells, where the farm settlement may contain a larger number of habitats attracting insects.

There were large differences between the five wells concerning moist conditions (Fig. 2), surrounding environments (Fig. 3) as well as the local environment and substrates (Fig. 4). It is also possible, however, that the prehistoric well was uncovered and therefore a much more effective trap for insects. Obligate aquatic species are more common in the Iron Age deposits than in the modern deposit (Fig. 2). They probably lived periodically or permanently directly in the well and, therefore, indicate that the prehistoric wells were not covered.

Despite being exposed to the air that could destroy the insect remnants, the stable sample was quite rich in insect remains. Not surprisingly, the stable floor sample contained more species adapted to indoor conditions (Tab. 1, Fig. 4). These insects live in substrates such as hay and straw waste, cereal debris, etc. A typical example is *Eupauloecus unicolor*, normally found in barns, stables and chicken huts. Another rich group was species that most likely lived in the stable refuse and compost situated outside, beside the stable. Decaying organic matter around and inside the stable and mouldy parts of the stable timber construction, attract species like *Lathridius minutus*, *Thes bergrothi* and *Corticaria pubescens*. Several of them are also considered as synantrophic (Fig. 4). In this particular investigation the stable floor is not comparable to the well samples, but the results are interesting complement and useful for future investigations.

There was a large number of insects other than beetles in the modern farm well sample. The most abundant insects are ants of the genera *Myrmica*, *Camponotus* and *Formica*, which inhabit the ground around the well (Fig. 5). In the same habitat is the bug, *Dolycoris baccarum*, inhabiting grassy places, feeding on flowers or fruits of a wide variety of herbaceous plants, as well as blackthorn and other rosaceous shrubs.

An obvious difference between the material from the modern farm and the Iron Age farms is a much stronger indication of open landscape in the general sense and more specifically cultivated fields in the Iron Age sample (Fig. 3). For example, while 5 taxa were found in the modern wells indicating generally open landscape, the numbers in two of the prehistoric wells were 16 and 13 taxa (Fig. 3). This difference is not easily understood, since the surroundings of the modern farm is characterized of generally open landscape and cultivated fields (Fig. 1). A natural cause of this difference could be the big change in the cultural landscape that has developed in time to a less diverse open and cultivated landscape and the use of pesticides and fertilizers. From both insect and pollen analysis it is clear that the Iron Age farms are situated in a more diverse, “mosaic”, cultural landscape (Hellqvist 1999, Lindström 1993). This “historical” landscape was composed of the habitats and environments that we today try to prevent as old cultural landscape offering attractive environment for many insects and plants.

Beetle species indicating such habitats as grazing land (Fig. 4), which closely surround the modern farm, are surprisingly rare in the material from the modern farm well. Dung beetles of the genus *Aphodius* are almost lacking in the modern material, although the well is situated between the barn and stable, where grazing and fresh dung has periodically been present. Dung beetles are occasionally observed to swarm around the farm settlement which should give possibilities for occasional deposition in the modern farm well. The low number might be explained by the behavior of dung beetles, as they do not move around on the ground far from droppings and that the well is carefully covered with an iron lid. The effect of ear-

*Table 1. Insect remains from the farm well (**I**), the stable floor (**S**) and the house well (**II**). Minimum numbers of individuals in each sample are calculated from the most abundant part. The nomenclature follows Lundberg (1986). Habitat preferences (Habitat) are indicated for each taxon: open landscape (O), forest (F), coniferous forest (Fc), deciduous forest (Fd), coniferous and deciduous forest (Fcd), aquatic (Aq), ponds, small lakes, pools (L), rivers, streams, brooks (R), water margins (Mw), hygrophilous (H), xerophilous (X), synanthropic (Sy), pests of timber (Pt), meadows and grassland (Gs), arable land (A), densely vegetated ground (DV), phytophagous (V), heath vegetation (He), tree feeders (T), coniferous trees (Tc), coniferous and deciduous trees (Tcd), picea (Tpc), shrubs (S), herbs (Vh), fungi (Vf), decaying organic matter (Do), dung (Du), carrion (Ca), leaf litter (Ll), moss (M). The modern geographical distribution within Europe is indicated (Distribution): distributed in the main part of Europe (E), central Scandinavia (CS) and arrow (↑) marks where the northernmost registered province for the taxa.*

*Lämningar av insekter lantgårdsbrunnen (**I**), stallet (**S**) och från husbrunnen (**II**). I varje prov beräknas minsta antalet individer från den mest frekvent förekommande kroppsdelen. Nomenklaturen följer Lundberg (1995). Habitat preferenserna indikeras för varje art enligt följande: generellt öppet landskap(O), skog (F), barrskog (Fc), lövskog (Fd), både barr- och lövskog (Fcd), akvatisk miljö (Aq), dammar, små sjöar och vattensamlingar (L), älvar, åar och vattendrag (R), stränder och kanter längs vatten (Mw), fuktiga miljöer, hygrofila (H), torra miljöer, xerofila (X), knutna till människans miljöer, synantropa (Sy), angriper timmer och trä (Pt), ängsmark och gräsmark (Gs), odlade ytor (A), tätbevuxen mark (DV), vegetationsberoende arter, fytofaga (V), hed vegetation (He), lever på träd (T), lever på barrträd (Tc), lever på barr- och lövträd (Tcd), lever på gran (Tpc), lever på olika slags buskar (S), lever på olika slags örter (Vh), lever på svamp (Vf), förmultnande organiskt material (Do), återfinns i gödsel (Du), lever i as (Ca), lövskräp (Ll), mossa (M). Den nutida geografiska utbredningen i Europa indikeras (Distribution): utbredd i större delen av Europa (E), centrala Skandinavien (CS) och pilen (↑) markerar det nordligaste registrerade länet för arten.*

Taxa	WI	S	WII	Habitat	Distribution
Heteroptera					
PENTATOMIDAE					
Dolycoris baccarum	1	1	-	V	-
Fam. Indet.	1	-	1	-	-
Hymenoptera					
FORMICIDAE					
Myrmica sp.	12	-	-	-	-
Camponotus sp.	1	-	-	T	-
Formica sp.	143	2	2	-	-
Fam. Indet.	8	2	-	-	-
Coleoptera					
CARABIDAE					
Leistus ferrugineus (L.)	1	-	-	O,X,(F),He,DV	E
Notiophilus palustris (Duft.)	-	1	-	O,H,(F)	E
Clivina fossor (L.)	4	1	2	O,Gs,Du,Do	E
? *Patrobus assimilis* Chau.	-	1	-	O,H,Fd	E
Trechus secalis (Payk.)	2	-	-	H,O,F,A,Do,Ll	E,↑CS
T. quadristriatus (Schr.)	2	-	-	O,(X),(F),A	E,↑CS
T. micros (Herbst)	2	-	-	H,Mw,R	E,↑CS
Bembidion gilvipes (Sturm)	1	-	-	H,Mw,Fd,S	E,↑CS
Bembidion sp.	1	-	-	-	-
Agonum sp.	3	-	-	-	-
Harpalus rufipes (DeG.)	-	-	1	O,(F),Ca,A	E
H. latus (L.)	1	-	-	O,He,Gs,A,Fd	E
H. tardus (Panz.)	-	1	-	X,O,A,(F)	E
H. sp.	1	1	-	-	-
Lebia chlorocephala (Hoff.)	-	-	1	O,(F),Gs	E,↑CS
Gen. indet.	-	1	-	-	-
HYDROPHILOIDEA					
Helophorus brevipalpis (Bedel)	5	-	-	Aq,L,R	E
Cercyon unipunctatus (L.)	1	-	-	Du,Do,Sy	E
C. sp.	1	-	-	-	-
Cryptopleurum minutum (Fabr.)	1	2	-	Mw,Du,Do,Ca	E
SILPHIDAE					
Phosphuga atrata (L.)	1	-	-	F	E

STAPHYLINIDAE					
Quedius sp.	2	2	1	-	-
Gyrohypnus angustatus Steph.	-	2	-	H, Do, Du	E
Xantholinus linearis (Oliv.)	3	-	-	Gs,Do,Ll	E
Xantholinae indet.	-	1	-	-	-
Lathrobium brunnipes (Fabr.)	6	-	-	H,Ll	E
L. sp.	-	-	1	-	-
Omalium caesum Grav.	-	-	3	Do,M	E
O. sp.	-	-	1	-	-
Olophrum consimile (Gyll.)	1	-	-	Mw,L,R,Do,Ll,M	↑CS
Arpedium quadrum (Grav.)	2	-	-	H,Ca,Ll,M	E
? *Acidota cruentata* Mann.	1	-	-	H,Ca,Ll,M	↑CS
Oxytelus sp.	-	2	-	-	-
Anotylus rugosus (Fabr.)	2	1	-	H,Mw,Du,Do	E
Tachyporus chrysomelinus (L.)	2	-	-	F.Mw,Gs,Ll,M	E
T. sp.	1	-	-	-	-
Aleocharinae indet.	1	1	-	-	-
Stenus sp.	1	-	-	-	-
Gen. indet.	1	1	-	-	-
SCARABAEIDAE					
Aphodius sp.	-	2	-	Du	-
ANOBIIDAE					
Eupauloecus unicolor (Pill. & Mitt.)	-	12	-	Do,Sy	E
Ptinus fur (L.)	-	4	-	Sy	E
Anobium punctatum (De Geer)	-	1	-	Tcd,Sy,Pt	E
MONOTOMIDAE					
Rhizophagus ferrugineus (Payk.)	1	-	-	Fcd,He,Gs,(Tpc)	E
CHRYPTOPHAGIDAE					
Cryptophagus sp.	-	12	-	-	-
Atomaria sp.	-	1	1	-	-
Gen. indet.	1	1	-	-	-
PHALACRIDAE					
Olibrus bicolor / *bimaculatus*	1	-	-	Vh	-
CORTICARIIDAE					
Latridius minutus (L.)	-	7	-	Vf,(T),Sy,Do	E
Thes bergrothi (Reitt.)	-	3	-	Sy,Do	E
Corticaria pubescens (Gyll.)	-	2	-	Mw,T,Do	E
Corticaria sp.	-	1	-	-	-
Gen. indet.	1	-	-	-	-
CERAMBYCIDAE					
Alosterna tabacicolor (De Geer)	-	1	-	Tcd	E
CHRYSOMELIDAE					
Gen. indet.	-	1	-	-	-
APIONIDAE					
Apion vicinum Kirby	-	-	1	H,Mw,Gs,Vh,M	↑CS
A. sp.	4	-	-	-	-
CURCULIONIDAE					
Otiorrhynchus ovatus (L.)	1	-	-	V	E
Sitona lineatus (L.)	-	1	-	O,A,V	E,↑CS
S. lepidus (Gyll.)	1	-	-	X,A,V	E
S. sp.	-	1	1	-	-
Hypera sp.	-	2	-	V	-
Notaris aethiops (Fabr.)	1	-	-	H,Mw,Vh	E
Magdalis ruficornis (L.)	1	-	-	V,S	E
M. sp.	-	1	-	Tcd	-
Gen. Indet	-	1	-	-	-
HYLESININAE					
Hylastes opacus Erich.	-	1	-	Tcd,Fcd	E
SCOLYTINAE					
Pityogenes chalcographus (L.)	-	1	-	Tc,Fc	E
Gen. indet.	-	1	-	-	-
Fam. indet.	-	4	-	-	-

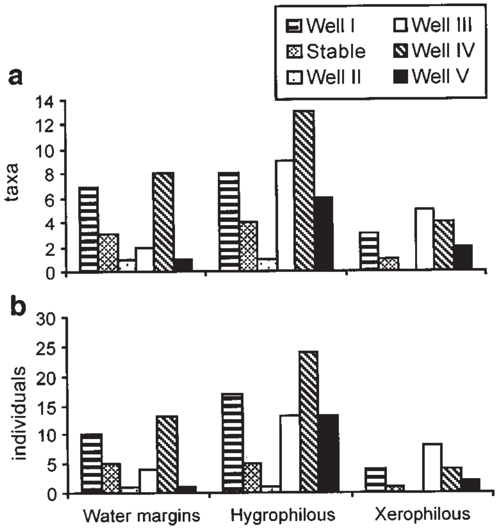

Figure 2. Number of ***a)*** *taxa and* ***b)*** *individuals of Coleoptera indicating differently moist habitats in six different deposits. Well I, Stable and Well II represnts moderns deposits whereas Well III-V are deposits from Roman Iron Age to the Migration Period (ca. 0-550 AD). Taxa may occur in more than one habitat category.*

Antal ***a)*** *taxa och* ***b)*** *individer av skalbaggar som indikerar förekomst av olika habitat. Fynden är från sex olika avlagringar. Well I, Stable och Well II är nutida avlegringar medan Well III-V är från Romersk järnålder till Folkvandringstid (ca 0-500 e.Kr.). En art kan förekomma i fler än en habitatkategori.*

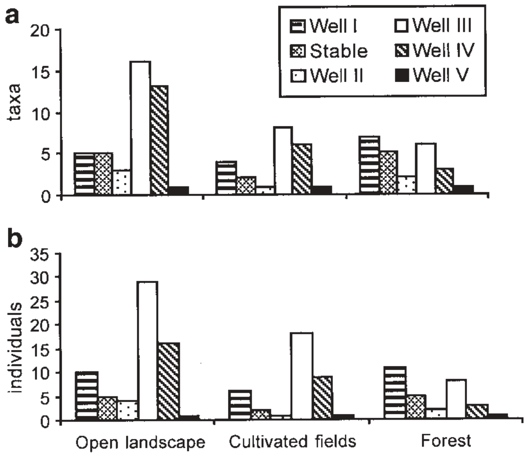

Figure 3. Number of ***a)*** *taxa and* ***b)*** *individuals of Coleoptera indicating differently open habitats in six different deposits. See also Fig. 4.*

Antal ***a)*** *taxa och* ***b)*** *individer av skalbaggar som indikerar förekomst av olika habitat. Fynden är från sex olika avlagringar. Se även figurtexten till Fig. 4.*

lier use of pesticides and fertilizers might be a limiting factor, but these were spread some distance from the settlement and have never been used in large quantities.

Both Wiktelius (1998) and Gustavsson (1998) discusses possible factors affecting the presence of dung beetles, like changed or decreased grazing activity. But Wiktelius (1998) also points to other factors that have a negative impact on the presence of dung beetle fauna in the pasture landscape, like grazing during shorter periods of the year and maybe not during the activity periods for several dung beetle species, the use of pesticides and the decrease in grazed areas to marginal parts of the landscape.

Another explanation to the difference in presence of dung beetles (*Aphodius*) could be that there was more frequent grazing near the prehistoric farm. It must also be considered that the prehistoric well was uncovered and may have been a more effective trap than the modern farm well. Another possible explanation is that the prehistoric well samples are made of filling material dumped into the well after its use, which sometimes may be dominated by dung and with remains of dung beetles. When dung beetles are found as remains in prehistoric and historic well deposits, they indicate grazing close to an uncovered well or have probably been deposited with substrates dumped into the well. The discussion about the dung beetles is an interesting insight to the prehistoric daily life and more investigations of this kind are needed.

The generally dominant substrates indicated from the wells presented here are decaying organic matter such as compost, manure and other sorts of litter that occur within the local environment (Fig. 4). This is a common picture from insect analysis in prehistoric deposits. Some habitats or substrates will sometimes automatically be over- or under-represented (*e.g.* Kenward 1978). The reason is that some habitats may generate more species adapted to them than others and that some species are more abundant than others. Decaying organic matter and dung are examples of two substrates that may be

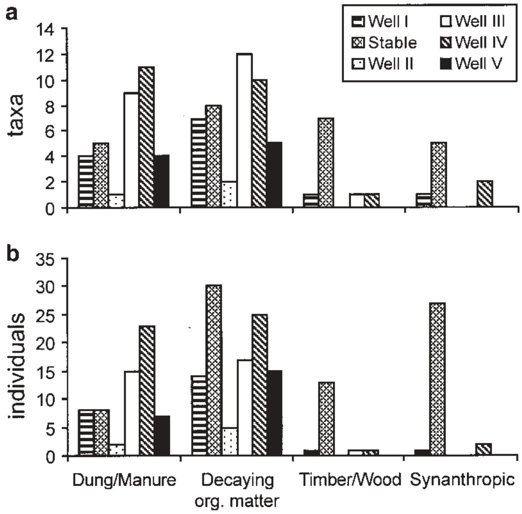

*Figure 4. Number of **a)** taxa and **b)** individuals of Coleoptera indicating differently substrates in six different deposits. See also Fig. 4.*

*Antal **a)** taxa och **b)** individer av skalbaggar som indikerar förekomst av olika substrat. Fynden är från sex olika avlagringar. Se även figurtexten till Fig. 4.*

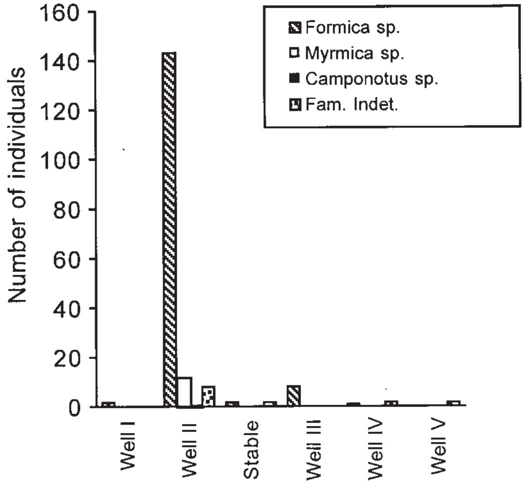

Figure 5. Number of individuals of subfossil ants from six different deposits.

Antalet individer av myror från den moderna lantgårdsbrunnen från sex olika avlagringar.

more common in the Iron Age farms, attracting insects adapted to them.

In the stable, several species were restricted to tree and wood, both coniferous and deciduous. This category is much more dominating in the stable than in the well samples (Fig. 4). In the present timber structure of the stable, there is a rather large infestation by the common furniture beetle, *Anobium punctatum.* However, only one individual was recognised in the stable floor sample. Wood living beetles are occasionally found in archaeological deposits and are of great interest since they may provide information on both former wooden constructions as well as the forest from where the wood was taken. From prehistoric deposits it is generally rather *Hadrobregmus pertinax* that has been found. This is the case both from the Iron Age well from Lundbacken (Hellqvist 1999) and in samples from the Medieval town Uppsala (Hellqvist & Lemdahl 1996).

The beetles indicating both coniferous and deciduous forests from both the stable and the modern farm well (I), do not particularly point to the presence of old trees, dead wood or rotting branches, even though the forest in the close vicinity has these three elements. These species apparently also require transport and dumping into the well, or to be derived from the wooden structure of the well. Less probable, they get trapped in an open uncovered well during flight. The forest implication from the insect remains is better in the modern farm well (I) than in any other of the compared well samples.

Even if there were several species found in well I that could inhabit forest environments in a more broad sense, it is the specimens from the stable sample that clearly indicate the forest. The bark beetles *Hylastes opacus* live on pine while *Pityogenes chalcographus* is found on the branches of spruce, but also in pine. These bark beetles could originate from the old forest west of the farm settlement, or from wood tranported to the farm.

Also species from aquatic environments, water margins and moist situations were found in numbers from the modern and prehistoric farm. Several of them may have found suitable habitats in temporary pools within the farm area. Both the modern farm and the Iron Age farm from Lundbacken (Well IV), are situated close to small rivers. Consequently in the well materials (Fig. 2) it is obvious that wet conditions were present. There is also a relative abundance of species that is found along river margins and aquatic habitats.

The large number of ants and ground-dwelling beetles clearly shows a natural activity at the ground in modern farm area (well I). Although the well is covered carefully with a top sealing, it does not necessarily have a negative impact on the accumulation of ground-living insects in the well. Remains of ants were also present in the Iron Age farm wells, especially from well III (Vallby, Fig. 5). The high number of individuals (143) in the modern farm well, could be a result of several causes – an ant society closely, that ants more easily get trapped in the farm well, large numbers of ants, or the short deposition time of the ant remains since the more fragile body parts of ants are destroyed easier during time than beetle remains.

Conclusion

Even though some insects from the environment evidently existing around the modern farm well is lacking as remains in the modern farm samples, it is possible to interpret a diverse picture corresponding to large parts of the present surrounding environments. This is an important conclusion for the discussion of using insect remains to interpret prehistoric landscape and settlements and how it corresponds to the environment. Investigations of prehistoric or historic wells usually provide a more diverse insect composition than modern wells and a broader picture of the environment around the settlement, with several insects indicating substrates such as dung and wood. Some general conclusions may be drawn from this investigation presented here.

Remains of beetles found in wells living in substrates like dung, tree or dead wood, not naturally dwelling on the ground around wells, pits etc., are proof of the substrates close to an uncovered well or has probably normally been dumped into the well with the substrates.

Substrates, environments and type of land use are difficult to quantify from the presence of connected insect remains in this kind of material, when found they merely indicate the presence of certain activities.

The insects provide a great deal of information for interpreting indoor environment and activity, but it is important to evaluate the indoor results and not exaggerate the value of certain indoor habitats or substrates.

Many species present in indoor samples are most probably result of random trapping from surrounding environments. Still, because of this mobility and behavior of several insect species, they can present very informative results about activities within a settlement or the surrounding environments.

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Sammanfattning

I arkeologiska undersökningar används ofta rester av insekter för att dra slutsatser om den omgivande miljöns historia. Vad man hittar i lämningarna beror dock inte bara på vilka insekter som hamnat i sedimentlagren utan också på hur väl de bevarats. Att förstå hur olika arter av insekter bevaras i arkeologiska lagerföljder är därför till stor hjälp vid tolkandet av arkeologiska data. Därför har jag här undersökt nutida lämningar av insekter, speciellt skalbaggar. Prover har tagits från en brunn och under ett stallgolv på en medelstor lantgård i Västmanland och dessutom från en brunn vid en fastighet ca 3 km öster om lantgården. Dessa brunnar var stenskodda och har alltid varit övertäckta av säkerhetsskäl, dock med några enstaka små hål där insekter har kunnat falla ner i brunnen. Stallgolvet var väl övertäckt, men med springor så att levande och döda insekter kunnat falla ner. De tre provtagningplatserna har noga kontrollerats så att de representerar ostörda provytor. Det har förekommit och förekommer än i dag aktivt bete i och omkring lantgården och runt lantgårdsbrunnen.

Proverna från den nutida miljön har jag jämfört med undersökningar av tre brunnar från järnålder. Dessa förhistoriska lantbruk dateras från romersk järnålder till folkvandringstid (ca 0-550 e.Kr.) och de ligger runt 25-30 km från den nutida gården (Hellqvist 1999).

Relativt många arter hittades i proverna från den moderna lantgården, 40 arter i brunnen och 36 i stallgolvet, medan brunnen vid den enskilda fastigheten enbart innehöll fragment av12 arter (Tab. 1). Artantalet är förvånansvärt högt med tanke på den kraftiga övertäckningen av brunnarna som funnits sedan de anlades och den aktivitet som förekommit i stallet. Arterna representerar väl den omgivande miljön. Vissa arter kan man förvänta sig att hitta i brunnen, som olika arter av jordlöpare (Carabidae) och ett större antal fragment av myror (Formicidae), där speciellt släktet *Formica* utmärker sig med minst 143 individer i lantgårdsbrunnen (Fig. 3). Även en del tillfälliga gäster har blivit deponerade, som barkborrar (Hylesininae och Scolytinae) vilka antingen kommit in med timmer till gården eller tillfälligt flugit förbi, då skog finns alldeles väster om gården.

En uppenbar skillnad mellan de förhistoriska och den nutida gårdens miljöer är att det förhistoriska materialet klart domineras av arter som indikerar generellt öppna områden och delvis även odlade fält (Fig. 1). Orsaken är antagligen att den förhistoriska miljön erbjöd en större mångfald i habitat och ett mångskiftande kulturlandskap, vilket dessutom låg i direkt anslutning till själva bosättningen.

Det nutida materialet skiljer sig även från det förhistoriska genom frånvaron av dynglevande skalbaggar. Bara två fragment från en obestämbar dyngbagge av släktet *Aphodius* hittades i brunnen på den moderna lantgården. Detta är kanske inte underligt med tanke på denna grupps specifika födoval och att de troligen inte rör sig på marken i samma omfattning som andra skalbaggsarter och därmed inte lika lätt fångas i brunnen. Dock finns dyngbaggar av släktet *Aphodius* frekvent på lantgården, de svärmar ibland i stort antal och bete har funnits kontinuerligt runt gården och även i direkt anslutning till brunnen.

Det faktum att just dyngbaggar (Scarabaeidae) är vanliga i förhistoriska avsättningar, som exempelvis brunnar, skapar vissa tolkningsfrågor. Vid undersökningen av de västmanländska järnåldersbrunnarna hittades 34 individer av dynglevande skalbaggar (Scarabaeidae), av dessa tillhörde nio arter släktet *Aphodius* och en släktet *Geotrupes*. En tolkning är att de fångats i brunnarna av en slump, vilket inte är troligt då dynglevande skalbaggar är vanligt förekommande i förhistoriska och historiska prover. Snarare har dessa, för tolkningen av människans förhistoriska miljöer så viktiga arter, hamnat i sina deponier i samband med att brunnar eller liknande konstruktioner tagits ur bruk och fyllts igen med skräp. Detta manar till försiktighet i samband med tolkning av dessa dynglevande arter i förhistoriska avsättningar. Samtidigt både förklarar det och ger möjligheter att studera denna viktiga grupp mer aktivt även i förhistoriska miljöer. Denna medvetna deponering av olika substrat ger antagligen en bredare bild av omgivningen och dess miljö än vad som normalt förväntas vara fallet med lämningar efter insekter vid förhistoriska avsättningar.

Resultatet från det moderna stallet utmärkte sig framför allt genom den betydligt högre andelen arter som är knutna till människans miljöer och även trä (Fig. 2). Detta är knappast förvånande, men det faktum att det är så tydligt i denna undersökning stärker möjligheterna till motsvarande tolkningar i förhistoriska material.