



# Cheshire Wildlife Trust

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## Heteroptera and Diptera surveys on the Cholmondeley Estate

by

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# Heteroptera and Diptera surveys on the Cholmondeley Estate

## Abstract

This report provides the results of a series of heteroptera and diptera surveys carried out in a variety of habitats in the Cholmondeley Estate in southern Cheshire. Six visits were made between April 2018 and August 2019, resulting in 909 individual records of the presence of a species in a 100m grid square on a specific date. This was part of a wider programme of surveys across a wide range of sites and habitats in Lancashire and Cheshire. A full list is given of the 343 species recorded and their distribution across four habitat types: Bickley Hall Farm, damp pastures, wet woodland and dry habitats. Species recorded at this site and nowhere else during these surveys are highlighted and discussed. The species list is interpreted in terms of habitat assemblages using the PANTHEON software available on the website of the Biological Records Centre.

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## INTRODUCTION

This report presents the results of surveys of the Heteroptera (true bugs) and Diptera (true flies) carried out over three summer seasons from 2017 to 2019 over a range of habitats in the Cholmondeley Estate, which is situated in Cheshire about 15km west of Crewe. These surveys were part of a wider programme carried by the author from 2012 to 2019 over the whole extent of South Lancashire (VC59) and Cheshire (VC58) with some additional coverage of VC60 north of the Ribble. An overall aim of these surveys has been to assess and compare the biodiversity of the insect fauna across a representative range of habitats with at least a local level of nature conservation interest.

The recording methodology (sweep-netting, with field observation for a few species) and the geographic scope of this programme are described in Brighton (2020). The total number of records accumulated over the region now stands at 3744 for the Heteroptera and 20,249 for the Diptera. Here a record refers to the detection of the species in a 100m square (ie six-figure grid reference) on a specific day. The number of species recorded overall is 177 for the bugs and 1292 for the flies. These figures represent 34% and 39% respectively of the national numbers of species in the families covered in the surveys. For the Heteroptera these were all the terrestrial species plus the aquatic bug family Saldidae, most species of which have a terrestrial lifestyle, giving 521 species in all\*. For the Diptera the range of families covered is specified in Brighton (2020) and currently includes 3300 British species.

Brighton (2020) has analysed the whole dataset to provide various measures of the diptera diversity at 6 individual sites where most surveying has been done and across the whole region where the surveys have been less intensive. The Cholmondeley Estate was chosen for particular attention as a mixed area of parkland, woods and agricultural land in the southernmost part of the overall region. This area has also received relatively little attention from entomological recorders in the past. The parkland covers approximately 240ha around the eponymous castle at SJ536513 and includes a SSSI, Chapel Mere, a eutrophic lake formed in a depression in the glacial drift deposits. The land around this mere is damp pasture, much of it grazed by cattle with small patches of damp woodland. The estate includes the 86ha of Bickley Hall Farm, leased by Cheshire Wildlife Trust who have their headquarters there and practice mixed wildlife-friendly farming. Other points sampled in the surveys were damp woodland and carr around Deer Park Mere and south of Moss Wood near Bickley church.

## SPECIES RECORDED

Figure 1 shows the distribution of the 100m squares surveyed with the number of records in each, while Table 1 shows the dates of visits and numbers of records from four broad habitat subdivisions.

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\* [https://www.britishbugs.org.uk/systematic\\_het.html](https://www.britishbugs.org.uk/systematic_het.html)

These show that effectively two separate surveys were carried out, one in the parkland around the castle, and the other to the south around Bickley. In both cases a generally similar itinerary was adopted on each visit, but exact replication of the survey squares was not considered necessary. The visit on 26 June 2018 was made as part of the summer field meeting of the Dipterists Forum and was more limited in scope than usual. Records from that field meeting are being collated and reported separately. The visits have been spaced over the seasons to allow for the short flight period of many, if not most species.

Table 2 shows the overall breakdown of species by the broad groups defined in Brighton (2020). Table 3 shows the complete species list with numbers of records. Sixteen species are marked with a double asterisk in the latter, denoting that they have not been recorded anywhere else in the course of the present surveys. Species with a single asterisk are those recorded in numbers significantly higher than expected from the whole regional dataset, using the statistical residuals as explained in Brighton (2020). These and other features of the species list are discussed next for each group in turn.

All records are publicly available on IRECORD ([www.brc.ac.uk/irecord/](http://www.brc.ac.uk/irecord/)).

## Heteroptera

The Heteroptera includes the shield-bugs and a large range of other predatory and plant-feeding bugs. They are generally associated with warmer and drier habitats, a tendency seen even in the rather small numbers in Table 1.

The species which were particularly well represented at Cholmondeley as marked by the asterisks illustrate a variety of life-styles. *Drymus sylvaticus* is from the ground-bug family Lygaeidae which is poorly represented in these surveys, since they are mainly found by searching on the ground rather than by sweeping the vegetation. It is known to feed on mosses at night (Southwood and Leston, 1959), but also vascular plants according to the [www.britishbugs.org.uk](http://www.britishbugs.org.uk) website.

The common damsel bug *Nabis rugosus* belongs to the Nabidae, a family of predatory bugs. It is rather elongated in shape as is the herbivorous *Notostira elongata* which feeds on grasses. *Orius laevigatus* from another predatory family Anthocoridae is one of the smallest bugs in the whole group, little more than 2mm in length, and like other members of the genus probably greatly under-recorded as a result. Its larger relative *Anthocoris nemorum*, the common flower bug, is the most frequently recorded bug in the whole set of surveys, as it is in the Cholmondeley results.

Like *Notostira elongata*, *Orthops basalis* is a member of the large family Miridae of mainly herbivorous bugs as are *Psallus perrisi* and *P. varians*. There are three British species of *Orthops* all associated with umbellifers (family Apiaceae). Both these *Psallus* species are found on oak.

Photographs of most of the species listed in Table 3 can be found on [www.britishbugs.org.uk](http://www.britishbugs.org.uk).

## Craneflies

Overall numbers of craneflies were rather disappointing considering the extensive wet habitats on the estate (see Fig. 4 of Brighton, 2020). The only species unique to Cholmondeley found in these surveys was *Trimicra pilipes*, which is one of the most widespread craneflies throughout the world, being found on every continent except Antarctica (Boardman, 2007). Its hairy legs are very distinctive, and it is found besides lakes and ponds with a draw-down zone of exposed wet mud (Dipterists Forum, unpublished keys): in this survey it turned up on the shore of Deer Park Mere.

*Atypophthalmus inustus* is a nationally scarce species normally associated with wet woodlands on association with decaying wood, though recorded here from one of the drier areas. *Dictenidia bimaculata* is another dead-wood specialist, found in the Bickley "swamp" near well-decayed birch, though generally it is not confined to wet habitats. While distinctive with spotted wings, it is infrequently recorded in the area (Boardman 2016, Brighton 2017).

*Nephrotoma cornicina* is one of the “tiger crane-flies” with bold black and yellow marking on the body, while *Tipula lunata* with a large yellowish brown body. The latter is a close relative of the common daddy-long-legs *T. oleracea* and *T. paludosa* which are responsible for leatherjackets in lawns and other grassland.

### Hoverflies

The best hunting ground for hoverflies are those with plenty of large nectar-rich flowers such as hogweed and ragwort. These were abundant on Bickley Hall farm during the August visit, but less often encountered elsewhere on the estate as revealed by the numbers in Tables 2 and 3. The two highlighted species *Anasimyia contracta* and *Lejogaster tarsata* are wetland species found by ponds on Bickley Hall Farm (see Figure 3). Interestingly the latter is mainly found in brackish environments (Stubbs and Falk, 2002) raising the question whether there is a saline influence here as at other inland locations in Cheshire.

### Empidoidea

The four families constituting this group currently contain 700 species recorded from Britain, and the species list is correspondingly longer. They are small to medium flies, almost all predaceous on smaller insects. The males of some species make presents of prey to the females as part of courtship – most of those in the large genus *Hilara* wrap these in silk produced by the swollen front metatarsi. Flies in the genus *Platypalpus* are rather small, while *Empis* and *Rhamphomyia* have many larger species. These last two are also equipped with a prominent proboscis, sometimes used for sucking nectar from flowers as well as the normal prey. The small *Tachydomia* species are noted for running around on tree trunks, and so are infrequently found by the general sweep-netting used in these surveys.

The family Dolichopodidae are small and longer legged, often with metallic body colours. While 18 species of these were found during these surveys, the Dipterists Forum visit in June 2018 found a total of 34 species in Cholmondeley Park, the result of a more targeted search for this family by the national recording scheme organiser (Drake, 2019).

Two species not found at Cholmondeley are so common in the overall survey that their absence is statistically significant: *Campsicnemus curvipes* and *Hercostomus aerosus*. These are 8<sup>th</sup> and 10<sup>th</sup> respectively in my overall ranking out of 1292 diptera species (Table 5 of Brighton, 2020). *Campsicnemus curvipes* is typically swept from wet or muddy places in damp woods, and is also renowned for hunting on the surface film of still waters, in almost any month of the year (d’Assis Fonseca, 1978). *C. curvipes* is very often found together with *C. scambus* and *C. loripes*, which also feature in the top 96 species overall – these two species do feature in the Cholmondeley records but in numbers much smaller than the other 6 main sites. *Hercostomus aerosus* follows a similar pattern, being more abundant at the 3 sites dominated by acid mires. This is somewhat paradoxical in view of the strong showing of flies associated with peatland habitats in the PANTHEON results (see §3 and Table 4 below)

### Calyptrates

This group of over 1000 British species includes the most stereotypical flies, in grey or brown colours, with many bristles over the body and legs which are important for identification. They also include some metallic coloured species such as blue-bottles (*Calliphora*) and green-bottles (*Lucilia*) as well as the cluster-flies (*Pollenia*) which sometimes congregate in window frames to over-winter. This was the largest group in the Cholmondeley survey, both in terms of species and records. Since the group indulges in a very wide range of life-styles, as wide perhaps as flies overall, it is hard to ascribe this to any particular reason.

The family Anthomyiidae, which contains 246 British species, has many ubiquitous species, which were regarded as difficult to identify until recent years with the development of a set of comprehensive keys and genitalia diagrams (Ackland *et al*, 2017). As far as known, all species of

genus *Anthomyia* breed in bird nests, or feed on vertebrate faeces and decomposing fungi. There has been little recording in the local region before the present surveys. The species listed here as unique to Cholmondeley, *Anthomyia pluvialis*, is well-known from further south: it is unusual in the family in being identifiable from photographs from the bold black markings on the light grey thorax.

*Delia criniventris* appears to have some association with *Lychnis* species, of which Ragged Robin is the only common one, and *D. lamelliseta* favours marshy places. The two *Hylemya* species and the two *Pegoplata* species are all coprophagous, and amongst the commonest of the family. The significantly higher than average numbers of these four species recorded across the Cholmondeley estate seems likely associated with the numbers of cattle present. This would also account for the enhanced numbers of the common yellow dung-fly *Scathophaga stercoraria* (family Scathophagidae). The adults of the last are predators of other fly species and can also be important as pollinators.

The Calliphoridae are the blowflies, mainly associated with dead animals, but *Bellardia* and *Pollenia* larvae are parasitoids of earthworms (Falk, 2016).

The Fanniidae is the family of the lesser house-flies, *Fannia canicularis*, though this large genus of 59 British species is mainly to be found around trees (d'Assis Fonseca, 1968). The Cholmondeley results are not inconsistent with this, as both the Chapel Mere and the dry habitats include wooded areas.

The Muscidae is the family of the common house-fly (*Musca domestica*). The larvae of genera such as *Helina*, *Limnophora* and *Phaonia* live in decaying organic matter including dung and are carnivorous. *Stomoxys calcitrans* is the "biting house-fly" which also breeds in cow-dung. The adult has a blood-sucking proboscis and may be found on cars in sunny weather, possibly mistaking them for large mammals.

The Scathophagidae also includes many species with phytophagous larvae. *Norellisoma lituratum* is associated with meadowsweet, though found in the drier part of Cholmondeley Park, while the larvae of *N. spinimanum* mine the stems of docks (Ball, 2013). *Norellia spinipes* is a miner of daffodils, near which it was found in this survey, and is notable for having spread across much England only in recent decades.

The Tachinidae are parasitic flies with larvae that attack other insects, primarily moths but also beetles, bugs or flies (Belshaw, 1993). The most frequent species *Siphona geniculata* has a long folding proboscis for feeding on nectar, and its host is large craneflies of the genus *Tipula*. *Eriothrix maculata* is often abundant on ragwort and is believed to be a parasitoid of moths, while *Exorista rustica* favours sawflies as hosts.

### Other Diptera

The families in this group have very little in common apart from being covered by relatively accessible identification resources.

The Anisopodidae are the window gnats, which have rather distinctively patterned wings shown to good advantage when they land on windows. The two species listed in Table 4 are usually swept in woods.

The visit to Bickley Hall Farm in June was memorable for the abundance of robberflies (Asilidae) in hay meadows and flowery field margins. The adults are top predators in the fly world. Perching on vegetation and darting out to seize passing flying insects including parasitic hymenoptera, sawflies and other diptera (or even their own kind) (Stubbs and Drake, 2014). *Dioctria atricapilla* (the violet black-legged robberfly) is a striking insect with dark wings and Prussian-blue eyes in the live male.

The Bibionidae include one of the most conspicuous insects of early spring, the large black St Mark's fly *Bibio marci*: the males that hover in swarms with dangling legs around trees and bushes.

The Chloropidae are a large family of small but sometimes colourful flies mostly eating live or decaying vegetable matter as larvae. As they often lurk low in the vegetation, they are not well sampled by general sweep-netting. Moreover, as comprehensive keys to the British species have yet to be developed, they have been generally omitted from this set of surveys.

The importance of Culicidae (mosquitoes) as a nuisance at best and a dangerous disease vector at worst means that they have been very thoroughly studied. However, they have only been included in these surveys in the last two seasons. The flooded woods around Deer Park Mere evidently provided a good breeding ground.

The Drosophilidae is another fairly large family of small flies, commonly encountered around compost heaps and other situations with decaying vegetable matter. *Drosophila suzukii* is a Japanese species infesting soft fruit which has spread across England over the last decade.

The larvae of the genus *Suillia* in family Heleomyzidae develop in fungi, as do many of the fungus gnats which include the family Keroplatidae. There are several other families of fungus gnat, and only a few particularly distinctive species have been included in these surveys. *Macrocera vittata* has exceptionally long antennae, more than twice the length of the body.

The Lauxaniidae are generally rather dumpy flies, brownish or often orange all over, and mainly found in shaded habitats. The genera *Calliopum* and *Minettia* include species adapted to drier open habitats (Ball, 2012), a pattern seen in the results in Table 3.

The three *Opomyza* species found at Cholmondeley are all included in the top 96 for which distributions across the 6 main survey sites are given in Table 5 of Brighton (2020). These yellowish brown flies with distinctively marked wings frequent grassy places, often in large numbers, and their larvae feed within grass stems (Drake, 1993). *O. germinationis* appears truly ubiquitous. *O. florum* seems to prefer acidic habitats, but *O. petrei* tends to avoid these, but the widespread occurrence of both these species at Cholmondeley may indicate that such associations are an over-simplification.

The abundance and diversity of snail-killing flies (Sciomyzidae) is certainly the most striking feature of the Cholmondeley surveys, with 4 species unique to the site in this set of surveys and 3 others with a significantly high number of records. *Anticheta obliviosa* is a nationally rare species: Ball (2017) states that it is only known from a few sites in the Huntingdon district (though his distribution map also shows a location just north of the Humber). *Sciomyza dryomyzina* is also nationally rare, though distributed in a wide swathe of the country from Kent and East Anglia to the North Midlands. *Colobaea punctata* and *Pherbellia dorsata* are nationally scarce species are more widespread in southern England but near their Northern limits here. As can be seen from Table 3, the Sciomyzidae were found mostly found on Bickley Hall Farm around the ponds (Fig. 4) and in the damp pastures around Chapel Mere. However, it is intriguing that only 1 species was shared between both locations which are separated by about 4km (A and D in Fig. 1). The *Anticheta* was found in the Bickley “swamp” (Fig. 2).

The small black antlike flies in the genus *Sepsis* can be seen walking on leaves waving their wings which have a strong spot near the apex. Four of the five common British species were recorded (*S. orthocnemis* being the exception). *Sepsis fulgens* is noted for forming large swarms on vegetation in late summer, a phenomenon observed on dense vegetation on the hill behind Cholmondeley Castle (Fig. 4). This is thought to be connected with winter hibernation (Pont 1987).

Like the snail-killing flies, the soldierflies (Stratiomyiidae) are particularly characteristic of wetland habitats (Stubbs and Drake, 2014), and that is seen in the results in Table 3. Five of the six British species of genus *Beris* have been recorded on the Estate including the elusive *B. clavipes*.

The final two species to mention are from the plant-eating family Tephritidae, most of whose members have attractively marked wings (White, 1988). *Dioxyna bidentis* has dark wings peppered with hyaline (transparent) spots – the larva attacks the flower-heads of bur-marigold (*Bidens*



*tripartita*) and probably other composites (Asteraceae). *Urophora quadrifasciata* is a species with black cross-bands on the wings and induces a gall in the knapweed (*Centaurea*) heads (Redfern *et al.* 2002).

Photographs of typical species from most of the diptera families mentioned above can be found at <https://www.naturespot.org.uk/taxonomy/term/22226>

## PANTHEON analysis

In view of the complexity in interpreting the data on individual species, it has been found more informative to assess the results in terms of the ecological characteristics of groups of species using the PANTHEON software. This is based on a database relating invertebrate species to their associated feeding characteristics as larvae and adults, habitats, conservation status and other ecological associations: this was originally developed as a tool for assessing SSSI quality in the Invertebrate Species-habitat Information System (ISIS) of English Nature (Webb & Lott, 2007), but in 2018 it was made publicly available for wider use by the Biological Record Centre under the new name with a user-friendly web-based interface at [www.brc.ac.uk/pantheon](http://www.brc.ac.uk/pantheon).

PANTHEON currently (Version 3.7.6) contains data for about 13,000 of the 37,000 species of the macro-invertebrate fauna of England. All British heteroptera species are covered. 3597 diptera species are included, just over half the British list. The analysis for this report uses simply the species lists in Table 3: it should be noted that the numbers of records are not used in the analysis, so each species has equal weight.

PANTHEON provides a variety of ways of analysing the data and presenting the results, from which a selection has been used for this report, as follows.

Figure 5 shows the breakdown of the combined species list across the sites by feeding guild\*. For both larvae and adults predators are the largest category. Larvae feeding on decaying matter constitute almost another third, and herbivores on live plants contribute around a fifth. For adults nectar-feeding species contribute just over a quarter, while non-feeders, herbivores and saprophagous species are also significant proportions. The nectar-feeding adult species include Muscidae (houseflies), Syrphidae (hoverflies) and other smaller fly families, showing the importance of this resource. These charts also illustrate the point that diptera species generally require different food resources as larvae and adults. Bugs however develop as a succession of nymphs like wingless adults rather than undergo a full metamorphosis, and so have similar diets through-out the life-cycle.

The proportions of the slices in these pie-charts generally vary rather little from site to site, as they are mainly determined by the range of heteroptera and diptera families recorded. However, compared with the results for Birkdale (Brighton, 2020a, Fig 3), the Cholmondeley results for larvae show a larger proportion of saprophagous species compared to herbivores – presumably a reflection of the dense and lush vegetation compared to the more sparsely vegetated dunes.

Table 4 shows the results from PANTHEON for the number of species associated with each habitat represented in the data. As some species have multiple associations, some habitats appearing on the Table, such as peatland, are not directly relevant. The figure for representation is the number of species recorded as a proportion of the total number in the PANTHEON database for that habitat. The guidance states that 10-20% may indicate good quality while 21% or more certainly suggests a good proportion of characteristic species. As these surveys cover species constituting only about a third of the PANTHEON data, it is considered that 7% may be taken as this threshold for a significant representation.

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\* Out of the 343 species recorded from the Cholmondeley Estate in this survey, 280 have data entries in PANTHEON.



At Cholmondeley, this figure is reached for shaded woodland floor species and for wet woodland (which appears under two of the broad biotope categories), in reasonable agreement with the general character of the site. The high representation of species with an affinity for peatland (including many of the Sciomyzidae) is somewhat surprising, but may reflect the origin of the landscape in glacial drift deposits, though any peat mires have clearly been effaced by conversion to agriculture or woodland.

Each species in the PANTHEON database is assigned a species quality score (SQS) according to their conservation status. Non-designated species score 1 while the SQS increases from 4 to 32 as one progresses from the nationally scarce or notable to the rarest categories such as critically endangered. The SQI is 100 times the sum of the scores divided by the number of species, so that 100 indicates a lack of any designated species. That peatland has the highest score again largely reflects the number of scarcer Sciomyzidae species recorded.

## DISCUSSION

Brighton (2020) discusses the proportions of the habitat associations further in a comparison with 5 other major sites. That report also includes the estimation of alpha and beta biodiversity measures based on the numbers of records for each Diptera species. The broad outcome of this analysis is that the Cholmondeley, though sampled less intensively than the other sites, has a similar level of diversity in terms of estimated numbers of species as measured by the Hill numbers (Figures 9 and 11 of Brighton, 2020) as the Delamere Forest. The range of species recorded is distinctive in terms of comparisons with the overall region and also in pairwise comparisons with the other 5 main sites, making a significant contribution to the regional diversity of diptera species.

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## TABLES

**Table 1:** numbers of heteroptera and diptera records by date and area

Date	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	Totals
16 April 2018	20				20
09 May 2018		101	61	47	209
26 June 2018		53	5		58
13 September 2018		106	84	33	223
03 June 2019	161			47	208
15 August 2019	177			14	191
<b>Totals</b>	<b>358</b>	<b>260</b>	<b>150</b>	<b>141</b>	<b>909</b>

**Table 2:** numbers of species recorded by group and area

Group	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	Overall
Terrestrial Heteroptera	16	5	14	4	31
Craneflies	5	16	9	17	34
Hoverflies	22	10	5	3	28
Empidoidea	22	16	22	24	55
Calyptrates	54	46	35	25	103
Other Diptera	48	44	24	27	92
<b>Totals</b>	<b>167</b>	<b>137</b>	<b>109</b>	<b>100</b>	<b>343</b>

**Table 3:** count of records for individual species by area. \*\* denotes species not found at any other sites in the present series of surveys (Brighton, 2020). For diptera, \* denotes species significantly over represented in the Cholmondeley data compared to the complete regional data.

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<b>1. HETEROPTERA</b>					
PLANT BUGS & ALLIES					
<i>Anthocoris nemoralis</i>		1			1
<i>Anthocoris nemorum</i>		4	4	3	14
<i>Blepharidopterus angulatus</i>		1			1
<i>Bryocoris pteridis</i>				1	1
<i>Closterotomus norwegicus</i>		1			1
<i>Corizus hyoscyami</i>		1			1
<i>Cymus melanocephalus</i>			2		2
<i>Dicyphus stachydis</i>				1	1
<i>Drymus sylvaticus</i> *				1	1
<i>Himacerus apterus</i>				1	1
<i>Kleidocerys resedae</i>				1	1
<i>Liocoris tripustulatus</i>				2	2
<i>Lygus rugulipennis</i>		3			3

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Monalocoris filicis</i>			1		1
<i>Nabis rugosus</i> *			1		1
<i>Notostira elongata</i> *	1	4			5
<i>Orius laevigatus</i> *				1	1
<i>Orius vicinus</i>	2				2
<i>Orthops basalis</i> *			1		1
<i>Orthotylus marginalis</i>	1				1
<i>Plagiognathus arbustorum</i>	2				2
<i>Psallus perrisi</i> *	2				2
<i>Psallus varians</i> *	1				1
<i>Scolopostethus thomsoni</i>			1		1
<i>Stenodema calcarata</i>	5	1			6
<i>Stenodema laevigata</i>	5	1	1		7
<i>Tingis ampliata</i>	1				1
<b>SHIELDBUGS &amp; ALLIES</b>					
<i>Dolycoris baccarum</i>			1		1
<i>Elasmotethus interstinctus</i>			1		1
<i>Palomena prasina</i>	1				1
<b>WATER BUGS</b>					
<i>Saldula saltatoria</i>			1		1
Count of records	32	12	17	6	67
<b>2. CRANEFLIES</b>					
<i>Achyrolimonia decemmaculata</i>				1	1
<i>Atypophthalmus inustus</i> *			1		1
<i>Austrolimnophila ochracea</i>				2	2
<i>Cheilotrichia cinerascens</i>		1	3	1	5
<i>Dicranomyia modesta</i>		2			2
<i>Dicranomyia morio</i>		1			1
<i>Dicranophragma adjunctum</i>		3			3
<i>Dicranophragma nemorale</i>		3			3
<i>Dictenidia bimaculata</i> *				1	1
<i>Erioconopa trivialis</i>		3			3
<i>Erioptera lutea</i>				1	1
<i>Helius longirostris</i>				1	1
<i>Limonia macrostigma</i>		2			2
<i>Limonia nubeculosa</i>		1	1	3	5
<i>Molophilus griseus</i>		4		2	6
<i>Molophilus obscurus</i>			1		1
<i>Nephrotoma appendiculata</i>			1		1
<i>Nephrotoma cornicina</i> *	1				1
<i>Ormosia hederæ</i>		4			4

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Phylidorea ferruginea</i>	1			2	3
<i>Ptychoptera albimana</i>		2			2
<i>Ptychoptera contaminata</i>				1	1
<i>Rhipidia maculata</i>			1		1
<i>Tasiocera murina</i>				1	1
<i>Tipula fulvipennis</i>	1				1
<i>Tipula luna</i>				1	1
<i>Tipula lunata*</i>	1			1	2
<i>Tipula oleracea</i>	1	1	1		3
<i>Tipula paludosa</i>		3	3	1	7
<i>Tipula unca</i>				1	1
<i>Tipula varipennis</i>		1			1
<i>Trichocera regelationis</i>		1			1
<i>Tricyphona immaculata</i>		4	1	2	7
<i>Trimicra pilipes**</i>				1	1
<b>Count of records</b>	5	36	13	23	77
<b>3. HOVERFLIES</b>					
<i>Anasimyia contracta*</i>	1				1
<i>Baccha elongata</i>			1		1
<i>Cheilosia albitarsis</i>		2			2
<i>Cheilosia pagana</i>	1				1
<i>Episyrphus balteatus</i>	2	1	1		4
<i>Eristalinus sepulchralis</i>	1				1
<i>Eristalis abusivus</i>	1				1
<i>Eristalis arbustorum</i>	2				2
<i>Eristalis nemorum</i>	1	1			2
<i>Eristalis pertinax</i>	1	1			2
<i>Eristalis tenax</i>	2				2
<i>Helophilus hybridus</i>	1				1
<i>Helophilus pendulus</i>	1	3			4
<i>Lejogaster tarsata*</i>	1				1
<i>Melanostoma mellinum</i>	5	4	1	1	11
<i>Melanostoma scalare</i>		1	3		4
<i>Neoascia meticulosa</i>	1				1
<i>Neoascia obliqua</i>		1			1
<i>Neoascia podagrica</i>		2			2
<i>Neoascia tenur</i>		1		1	2
<i>Platycheirus albimanus</i>	1				1
<i>Platycheirus angustatus</i>	5				5
<i>Platycheirus clypeatus</i>	3		1	1	5
<i>Platycheirus rosarum</i>	1				1

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Riponnensia splendens</i>	1				1
<i>Sphaerophoria scripta</i>	2				2
<i>Syrpitta pipiens</i>	1				1
<i>Syrphus ribesii</i>	1				1
<b>Count of records</b>	<b>36</b>	<b>17</b>	<b>7</b>	<b>3</b>	<b>63</b>
<b>4. EMPIDOIDEA</b>					
DOLICHOPODIDAE					
<i>Campsicnemus loripes</i>				2	2
<i>Campsicnemus scambus</i>				1	1
<i>Chrysotus cilipes</i>	1				1
<i>Chrysotus gramineus</i>	3		1		4
<i>Chrysotus neglectus*</i>	4				4
<i>Dolichopus claviger*</i>	1				1
<i>Dolichopus latilimbatus*</i>	2				2
<i>Dolichopus plumipes</i>	3	1		1	5
<i>Dolichopus popularis</i>				1	1
<i>Dolichopus trivialis</i>	1		1		2
<i>Dolichopus unguulatus</i>	3				3
<i>Hercostomus metallicus</i>		1		2	3
<i>Hercostomus silvestris**</i>				1	1
<i>Medetera truncorum</i>	1				1
<i>Rhaphium appendiculatum</i>		1			1
<i>Sympycnus desoutteri</i>	2		1	1	4
<i>Syntormon denticulatum</i>		1			1
<i>Xanthochlorus galbanus</i>			1		1
EMPIDIDAE					
<i>Dolichocephala guttata</i>				1	1
<i>Empis caudatula*</i>	3				3
<i>Empis chioptera*</i>		3	2	1	6
<i>Empis nigripes</i>	1		2	1	4
<i>Empis nuntia</i>			1		1
<i>Empis opaca*</i>			1	1	2
<i>Empis stercorea</i>			1	1	2
<i>Empis tessellata</i>			1		1
<i>Empis trigramma</i>		1	1		2
<i>Hilara brevistyla</i>				1	1
<i>Hilara clypeata*</i>	2		1		3
<i>Hilara fuscipes</i>			1		1
<i>Hilara maura</i>			1	1	2
<i>Hilara monedula</i>	1				1
<i>Hilara quadrifasciata</i>	1			1	2

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Hilara subpollinosa</i>	1				1
<i>Rhamphomyia albohirta</i>			2		2
<i>Rhamphomyia crassirostris</i> *		1		3	4
<i>Rhamphomyia erythropthalma</i>			1		1
<i>Rhamphomyia pilifer</i>		1			1
<i>Rhamphomyia subcinerascens</i> *		1	1		2
<i>Rhamphomyia sulcata</i>		1			1
<i>Rhamphomyia tibiella</i>		2			2
<i>Rhamphomyia umbripennis</i> *		3	1		4
HYBOTIDAE					
<i>Bicellaria simplicipes</i> *				1	1
<i>Bicellaria vana</i>	4	1	1		6
<i>Hybos culiciformis</i>			1	1	2
<i>Hybos femoratus</i>				1	1
<i>Ocydromia glabricula</i> *	1	3	4	5	13
<i>Platypalpus agilis</i> *		1		2	3
<i>Platypalpus candicans</i>				1	1
<i>Platypalpus longiseta</i>	2				2
<i>Platypalpus maculipes</i> **	2				2
<i>Platypalpus minutus</i> *	7	1		1	9
<i>Platypalpus pallidiventris</i>	3				3
<i>Tachydromia aemula</i> **			1		1
<i>Tachypeza nubila</i>				1	1
<b>Count of records</b>	49	23	28	33	133
5. CALYPTRATES					
ANTHOMYIIDAE					
<i>Adia cinerella</i>		1			1
<i>Anthomyia liturata</i> *	5	3	2	1	11
<i>Anthomyia pluvialis</i> **	1				1
<i>Anthomyia procellaris</i>	1				1
<i>Botanophila brunneilinea</i> *	2				2
<i>Botanophila discreta</i> *	1	1	2		4
<i>Botanophila fugax</i> *	3	4	2	2	11
<i>Chirosia betuleti</i>		1			1
<i>Chirosia grossicauda</i>				1	1
<i>Delia coarctata</i>	1				1
<i>Delia criniventris</i> **	1				1
<i>Delia florilega</i>	1	1			2
<i>Delia lamelliseta</i> *		1			1
<i>Delia platura</i>	5		2		7
<i>Delia radicum</i>	1				1



Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Hylemya nigrimana</i>			1		1
<i>Hylemya urbica</i>			1		1
<i>Hylemya vagans</i> *	1		4	4	9
<i>Hylemya variata</i> *	5	2	1	1	9
<i>Lasiomma picipes</i>	1				1
<i>Lasiomma seminitidum</i>			2		2
<i>Lasiomma strigilatum</i>	1				1
<i>Paradelia intersecta</i>	1				1
<i>Pegomya bicolor</i>	1				1
<i>Pegoplata aestiva</i> *	5		1		6
<i>Pegoplata infirma</i> *	8	4	1		13
<i>Phorbia fumigata</i>		1	1		2
CALLIPHORIDAE					
<i>Bellardia viarum</i> *	1	2			3
<i>Bellardia vulgaris</i>	2	1			3
<i>Melanomya nana</i>	1				1
<i>Melinda viridicyanea</i>	2				2
<i>Pollenia angustigena</i>		2			2
<i>Pollenia pediculata</i> *	7	2			9
FANNIIDAE					
<i>Fannia armata</i>	1				1
<i>Fannia genualis</i>			1		1
<i>Fannia lepida</i> *		1	1		2
<i>Fannia mollissima</i>		1			1
<i>Fannia pallitibia</i>			2		2
<i>Fannia parva</i>		1			1
<i>Fannia postica</i>		2			2
<i>Fannia serena</i> *	2	10	2	1	15
<i>Fannia similis</i> *	1	2		1	4
<i>Fannia sociella</i>				1	1
<i>Fannia subsimilis</i>		2			2
MUSCIDAE					
<i>Azelia cilipes</i>	1	2		1	4
<i>Azelia nebulosa</i> *	1		1	3	5
<i>Azelia zetterstedtii</i>			1		1
<i>Coenosia intermedia</i>				1	1
<i>Coenosia tigrina</i>	6	2		1	9
<i>Eudasyphora cyanella</i>		1	1		2
<i>Hebecnema nigra</i>				1	1
<i>Hebecnema nigricolor</i>			1	2	3
<i>Hebecnema umbratica</i> *	3	3	2		8
<i>Hebecnema vespertina</i>		4	1		5

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Helina depuncta</i>		1	3		4
<i>Helina impuncta</i>		3			3
<i>Helina intermedia**</i>	1				1
<i>Helina obscurata</i>		1			1
<i>Helina quadrum</i>	1				1
<i>Helina reversio</i>	4		1	1	6
<i>Helina setiventris</i>	1				1
<i>Hydrotaea albipuncta*</i>	2				2
<i>Limnophora tigrina</i>	1				1
<i>Limnophora triangula</i>	1			1	2
<i>Lispocephala alma</i>				1	1
<i>Mesembrina meridiana</i>		1			1
<i>Morellia simplex</i>			1		1
<i>Musca autumnalis</i>	1				1
<i>Mydaea ancilla</i>	1				1
<i>Myospila meditabunda*</i>	3				3
<i>Neomyia cornicina*</i>	3	3			6
<i>Phaonia halterata*</i>		7			7
<i>Phaonia incana</i>	1	1			2
<i>Phaonia perdita**</i>	1				1
<i>Phaonia serva</i>		1			1
<i>Phaonia tuguriorum</i>		2			2
<i>Phaonia valida*</i>			2		2
<i>Polietes domitor</i>		1			1
<i>Polietes meridionalis</i>				1	1
<i>Stomoxys calcitrans*</i>			1	1	2
SARCOPHAGIDAE					
<i>Sarcophaga carnaria</i>	1	1			2
<i>Sarcophaga haemorrhoea</i>	1				1
<i>Sarcophaga vagans</i>	1				1
SCATHOPHAGIDAE					
<i>Cordilura albipes*</i>		2	1	1	4
<i>Cordilura ciliata</i>				1	1
<i>Nanna fasciata</i>		3	1	1	5
<i>Norellia spinipes</i>	1				1
<i>Norellisoma lituratum**</i>			1		1
<i>Norellisoma spinimanum</i>			1		1
<i>Scathophaga furcata</i>				1	1
<i>Scathophaga inquinata</i>		1			1
<i>Scathophaga stercoraria*</i>	17	6	4	3	30
<i>Scathophaga suilla</i>		1			1
TACHINIDAE					

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Dexiosoma caninum</i>			1		1
<i>Eriothrix rufomaculata</i> *	4				4
<i>Eurithia anthophila</i>	1				1
<i>Exorista rustica</i> *	2				2
<i>Lydella stabulans</i>	1				1
<i>Meigenia</i> sp.		1			1
<i>Pales pavidus</i>		1			1
<i>Phryxe vulgaris</i>		1			1
<i>Siphona geniculata</i> *	3	3	1	2	9
<i>Siphona maculata</i>			1		1
<b>Count of records</b>	126	98	52	35	311
<b>6. OTHER DIPTERA</b>					
ANISOPODIDAE					
<i>Sylvicola cinctus</i>	1			1	2
<i>Sylvicola punctatus</i>		3	1	1	5
ASILIDAE					
<i>Dioctria atricapilla</i> *	1				1
<i>Dioctria baumhaueri</i>	1				1
<i>Dioctria rufipes</i> *	5				5
<i>Leptogaster cylindrica</i>	2				2
BIBIONIDAE					
<i>Bibio leucopterus</i> *		2		1	3
<i>Bibio marci</i>		2	2		4
<i>Dilophus febrilis</i>	6	3	1		10
<i>Dilophus femoratus</i>	1				1
CHLOROPIDAE					
<i>Chlorops brevimanus</i> **				1	1
<i>Chlorops pumilionis</i> *	2				2
<i>Elachiptera cornuta</i>	1				1
<i>Thaumatomyia notata</i>	1				1
CULICIDAE					
<i>Aedes annulipes</i> *				2	2
<i>Aedes cantans</i> *			1	2	3
<i>Culex pipiens</i> *		2	1	2	5
<i>Culiseta annulata</i>				1	1
DROSOPHILIDAE					
<i>Drosophila suzukii</i>			1		1
<i>Hirtodrosophila cameraria</i> *		1			1
<i>Lordiphosa fenestrarum</i> *	1				1
<i>Scaptomyza pallida</i>	3				3
DRYOMYZIDAE					

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Neuroctena anilis</i>		2	1		3
EPHYDRIDAE					
<i>Coenia curvicauda</i>	1				1
HELEOMYZIDAE					
<i>Suillia affinis</i>				1	1
<i>Suillia dumicola</i> **		1			1
<i>Suillia variegata</i>			1		1
KEROPLATIDAE					
<i>Macrocera vittata</i> *		2		1	3
LAUXANIIDAE					
<i>Calliopum aeneum</i>	1				1
<i>Meiosimyza platycephala</i>			1		1
<i>Meiosimyza rorida</i> *		1	2	4	7
<i>Minettia fasciata</i>	1	1			2
<i>Minettia inusta</i> *	1				1
<i>Tricholauxania praeusta</i>		1	1		2
LONCHOPTERIDAE					
<i>Lonchoptera bifurcata</i>	6	2	1	1	10
<i>Lonchoptera lutea</i>	6	6	3	3	18
OPETIIDAE					
<i>Opetia nigra</i>		1	1		2
OPOMYZIDAE					
<i>Geomyza balachowskyi</i>		1	1		2
<i>Geomyza tripunctata</i>	2	1	1		4
<i>Opomyza florum</i>	1	4	3	2	10
<i>Opomyza germinationis</i>	1	2	2		5
<i>Opomyza petrei</i> *	5	4	2	1	12
PALLOPTERIDAE					
<i>Palloptera scutellata</i>		1			1
PSILIDAE					
<i>Loxocera albisetata</i>		1			1
RHAGIONIDAE					
<i>Rhagio lineola</i>		2			2
<i>Rhagio scolopaceus</i>				1	1
SCIARIDAE					
<i>Schwenckfeldina carbonaria</i>		1	1		2
SCIOMYZIDAE					
<i>Anticheta obliviosa</i> **				1	1
<i>Colobaea punctata</i> **	1				1
<i>Coremacera marginata</i>	1				1
<i>Elgiva cucularia</i>	1				1
<i>Ilione albisetata</i>	2				2

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Pherbellia dorsata</i> **	1				1
<i>Pherbellia griseola</i>	1	1			2
<i>Pherbellia schoenherri</i>		2			2
<i>Pherbellia ventralis</i>	2				2
<i>Pherbina coryleti</i>		1			1
<i>Sciomyza dryomyzina</i> **		1			1
<i>Sepedon sphegea</i> *	4				4
<i>Sepedon spinipes</i> *	2				2
<i>Tetanocera elata</i>		1	1		2
<i>Tetanocera ferruginea</i> *		1		3	4
SEPSIDAE					
<i>Sepsis cynipsea</i>	9	1		1	11
<i>Sepsis flavimana</i>		2			2
<i>Sepsis fulgens</i> *	9	2	2	2	15
<i>Sepsis punctum</i>	3	1	1		5
<i>Sepsis violacea</i>	2				2
<i>Themira annulipes</i>	1	1			2
<i>Themira minor</i>	1				1
SPHAEROCERIDAE					
<i>Copromyza nigrina</i>				1	1
<i>Copromyza stercoraria</i>		1			1
<i>Crumomyia fimetaria</i>				2	2
<i>Crumomyia nitida</i>				1	1
<i>Leptocera fontinalis</i>	2	2		2	6
<i>Leptocera nigra</i>	3				3
<i>Limosina silvatica</i>				1	1
<i>Lotophila atra</i>	5	1			6
<i>Rachispoda lutosa</i>				1	1
STRATIOMYIDAE					
<i>Beris chalybata</i>		4		1	5
<i>Beris clavipes</i> *	1				1
<i>Beris fuscipes</i>		1			1
<i>Beris geniculata</i>	1				1
<i>Beris vallata</i>		1			1
<i>Chloromyia formosa</i>	1	1			2
<i>Microchrysa cyaneiventris</i>		1			1
<i>Microchrysa flavicornis</i>	1				1
TABANIDAE					
<i>Haematopota pluvialis</i>		1			1
TEPHRIDAE					
<i>Dioxyna bidentis</i> *	1				1
<i>Tephritis formosa</i>	2				2

Recording group, family & species	Area				Totals
	Bickley Hall Farm	Chapel Mere	Dry habitats	Wet woodland	
<i>Tephritis neesii</i>	2				2
<i>Tephritis vespertina</i>			1		1
<i>Urophora quadrifasciata**</i>	1				1
<b>Count of records</b>	110	74	33	41	258

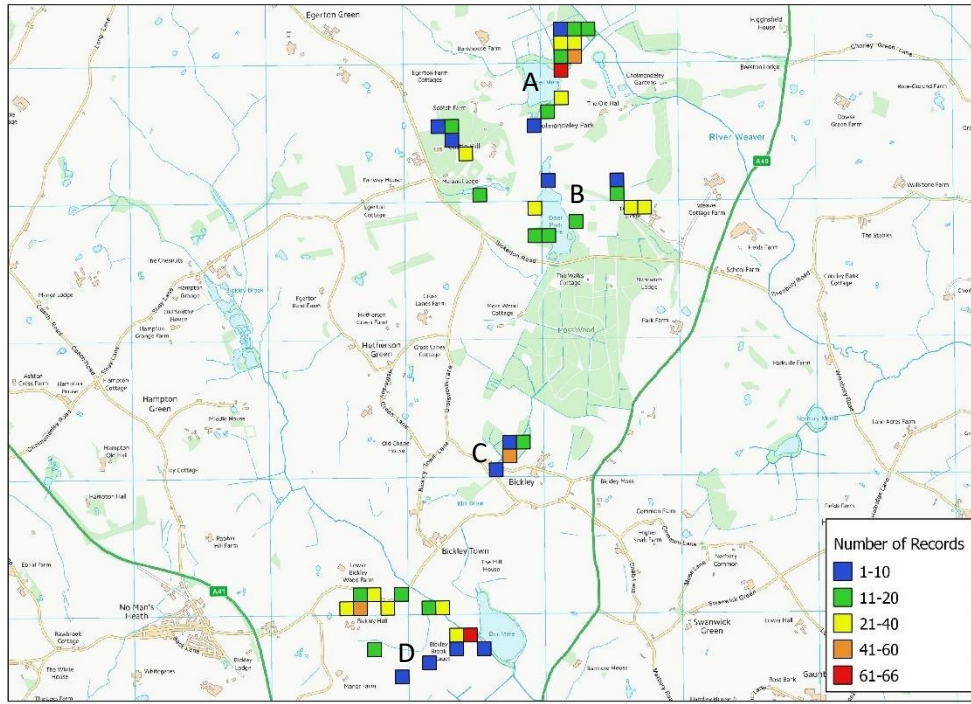
**Table 4:** PANTHEON habitat scores

Broad biotope	Habitat	No. of species	% representation	SQI	Species with conservation status
<b>tree-associated</b>	shaded woodland floor	96	9	117	4
<b>open habitats</b>	tall sward & scrub	85	3	100	
<b>wetland</b>	peatland	55	5	148	6
<b>wetland</b>	marshland	45	5	139	3
<b>wetland</b>	running water	25	2	125	
<b>wetland</b>	wet woodland	20	7	116	
<b>tree-associated</b>	wet woodland	20	8	116	
<b>tree-associated</b>	decaying wood	9	<1	133	1
<b>tree-associated</b>	arboreal	8	<1	100	
<b>open habitats</b>	short sward & bare ground	6	<1	100	
<b>open habitats</b>	upland	2	1	100	



## FIGURES

**Figure 1.** Map of the 100m survey squares with numbers of records in each. A marks the location of Chapel Mere which is bordered by extensive wet meadows. B is Deer Park Mere, largely surrounded by wet woodland. C is the location of an area of willow carr just north of Bickley church (see Figure 2). D marks Bickley Hall Farm.



**Figure 2.** Willow carr at Bickley (C in Fig. 1): location for *Anticheta obliquosa*





**Figure 3.** Bickley Hall Farm: marshy pond near Barmere (red square at D in Fig. 1)



**Figure 4.** *Sepsis fulgens* swarm on vegetation on the hill behind Cholmondeley Castle



**Figure 5:** PANTHEON results for numbers of species by feeding guild (280 species analysed)

