

The invertebrate fauna of Mill Bank, Penallt, Monmouthshire, Wales: a traditionally managed biological hotspot in the Wye Valley

PAUL F. WHITEHEAD

Moor Leys, Little Comberton, Pershore, Worcestershire, England WR10 3EH, U.K.

email: paulfw@outlook.com

ABSTRACT

The entomofauna of a small-holding in south-east Wales has been investigated since 1998 and in greater detail since 2010. An account of this fauna is presented with emphasis placed on the wider implications and impacts of land management, sustainable systems and site fidelity. Psocoptera, Lepidoptera, Coleoptera and Hymenoptera underpin these concepts and are discussed in detail. The developmental history of the entomofauna is supported by historical documentation.

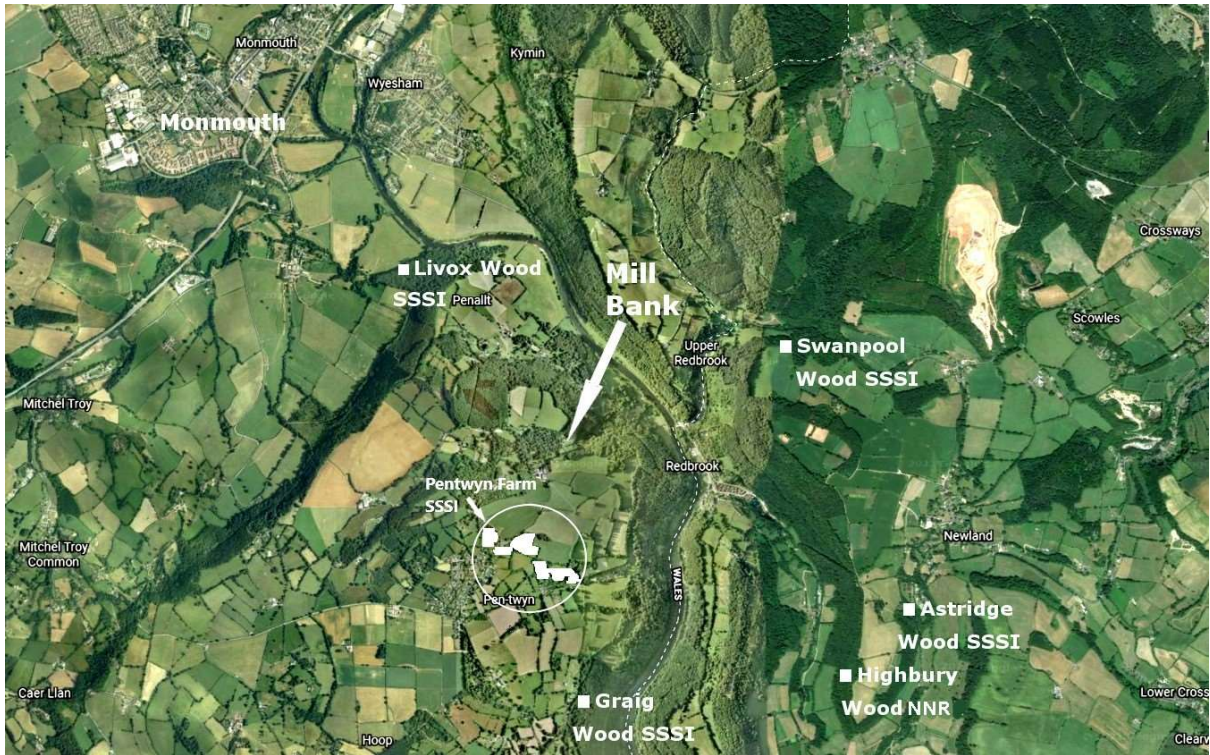
Keywords: Wales, Wye Valley, smallholding, management, entomofauna, diversity, status, fidelity

INTRODUCTION

Mill Bank is a land area situated in the lower catchment of the River Wye in the deeply incised valley of the Black Brook at Penallt in Trellech United Parish, Monmouthshire (51°78'N 02°68'W VC35 SO527100), ranging in altitude from about 113 m to 131 m a.s.l. Black Brook rises to the west at a height of c150m its thalweg here descending to the River Wye, 750 m to the east, at an angle of about 15°. The steepest angle of slope is 26° on the southern valley side and 35° on the northern side (Fig. 3). The rapid flow of the brook through a mosaic of boulder-impounded pools is reasonably constant but was dramatically reversed in the summer drought of 2022 when it ran dry for the first time in at least 25 years.

The site originally accommodated two stone cottages of which the remaining one is a permanent residence (Fig. 3) bearing the site name that stems from the documented observation that Black Brook once serviced a mill. Devonian Old Red Sandstone and Quartz Conglomerate laid down 370 million years ago outcrop on the northern side as low cliffs quarried for millstones fabricated on site since medieval time (Tucker, 1971a). Enormous blocks of these rocks have been emplaced downslope of the cottage to form parallel walls which define and support terrace flats above them and a similar retaining wall immediately behind the cottage supports violets favoured by fritillaries. These walls form a key habitat for invertebrates and extend as far downslope as The Dingle. Within them the Flowery Bank (Fig. 2) of MG5 phytoassociation (Rodwell, 1992) is mown once in autumn.

Mill Bank is a Local Wildlife Site (Gwent Wildlife Trust Reference WS/SO51/03) notified in 2005 for its floristic interest. It occupies a central position in the south of the 58 mile long Wye Valley AONB (Fig. 1). A number of designated woodlands flank the Wye Valley SSSI which collectively form the Wye Valley Woodland Special Area of Conservation (SAC). The northern woodlands located on the Devonian outcrops (Figs 1, 2, 3) are distinct in composition and faunistics to the woodlands that drape the geologically more recent Carboniferous Limestones of the southern gorge (Peterken, 2008a) aspects of the entomofauna of which have been reviewed by Howe, Alexander & Bacon (2022). The invertebrates of the wider valley woodlands have been reported on by Alexander (2019, 2021) and Whitehead (2013). In the interests of conciseness this account employs charts, tables and figures which, when viewed together, amalgamate the relationships of species to the landscape and land use changes that are documented.



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Fig. 1. Mill Bank situated 750 m east of the River Wye in relation to land use and physiography.



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Fig. 2. Mill Bank showing existing land use and landscape matrix. The curtilage defined by the white line extends to c2 ha and accommodates the invertebrate fauna discussed here.



Fig 3. Mill Bank. A visual transect in correspondence with Fig. 2 looking north-west over the Black Brook valley from Orchard Field.

THE MILL BANK LANDSCAPE

Landscape, landscape matrix and physiography are illustrated clearly in Figs 1, 2 and 3. Built development downslope of Mill Bank is scattered and higher ground to the north is mostly open country, wooded with some agricultural clearances and with elements of original heathland some of which is being restored. Some heathland insects occur at Mill Bank. The whole of the Trellech ridge from the boundaries of the Troy Park estate south to Devauden was known historically as Wysewood Common, a royal hunting forest. This ridge is bounded on the east by the lower Wye valley and on the west by farmland, heathland and small encroachments. These encroachments and small enclosures created Mill Bank as it now is; the wider impacts of these clearances are documented by Peterken (2008a; 2008b).

The dissected topography and resultant range of aspects and slopes (Fig. 3) drive much of the extant invertebrate fauna. Highly insolated in winter, temperature inversions in the valley below may create an alpine feel which impacts strongly on thermophilous invertebrates especially around the house and south-facing terrace walls. Red Admiral butterflies *Vanessa atalanta* (Linnaeus, 1758) may be observed flying in January quite frequently. This distinctive topography was forged by cold-climate processes that drove ice down the western side of Britain and glaciated most of Wales and the Bristol Channel (Jones & Keen, 1993; Mitchell, 1968) during the Wolstonian Glaciation of Marine Isotope Stage 6 (Rose, 2014). These ice sheets reversed the drainage of the regional rivers and ponded proglacial lakes, the liberation of which, according to Harris (2000), eventually cut the gorge. More recent well-founded hypotheses for the creation of such gorges involve subglacial drainage flowing under intense pressure. Cold-climate debris that impeded the post last-glacial drainage of the River Wye created a lake basin as far upstream as Monmouth (Clarke, 2013) that even now impacts on regional valley woodlands and entomofaunas.

Much of the bed of the Black Brook is floored with contiguous boulders of water-smoothed local rock that allows the flow to become subterranean in places, a feature which more usually characterises higher ground in Britain. The brook supports key invertebrates including temporal relict

species. The valley side is marked by alder trees including veteran pollards believed to exceed two hundred years of age and doubtless used by early plot holders; these are of considerable invertebrate importance.

Blackbrook Wood is an ancient valley-side vestige of the Forest of Wyewood that escaped complete clearance and which supports notably large Sweet Chestnut (*Castanea sativa* Miller), Pedunculate Oak (*Quercus robur* Linnaeus) and alder trees (*Alnus glutinosa* (L.) Gaertn.), creating a major landscape feature on the north side of the valley. The woodland floor is littered with angular blocks of Quartz Conglomerate most recently emplaced *en masse* by freeze-thaw processes during the last ice age. Enormous monolithic blocks of conglomerate mark the valley floor below the barn; these were evidently set by man, probably in medieval times. As moss and lichen-covered features they are of entomological interest supporting some species of invertebrates more usually associated with immature or well-drained minerogenic sediments. The diverse associations of mosses, lichens and liverworts was confirmed on 5 April 2018 when Mr S. Bosanquet recorded 52 species of moss in 21 families and 40 species of lichen in 18 families, many of which support specialised insects (Figs 10:3, 4).

At its lowest point Black Brook passes through The Dingle (Fig. 2). This is a managed riparian wildwood remnant composed of alder (*A. glutinosa*), high canopy ash (*Fraxinus excelsior* Linnaeus), willow (*Salix caprea* Linnaeus), coppiced hazel (*Corylus avellana* Linnaeus) and high canopy cherry (*Prunus avium* Linnaeus) that overtop a diverse range of native herbaceous plants and associated entomofauna (Table 1). These include Moschatel (*Adoxa moschatellina* Linnaeus), Solomon's Seal (*Polygonatum multiflorum* (Linnaeus) All.), carpets of daffodil (*Narcissus pseudonarcissus* Linnaeus) and snowdrop (*Galanthus nivalis* Linnaeus). The north-facing slope accommodates a traditional orchard comprising unique, rare and distinctive top fruit varieties, its upslope western boundary defined by what is now the Hayfield. Mown swards to the west of the cottage merge into ribbons of wild flowers above the rock outcrop which the house abuts. The western boundary of the northern slope is defined by the edge of a pasture (Figs 2, 3) that supports 14 species of waxcap fungi. To the east Pwll-Mawr (Figs 1, 2) is marked by a larch plantation (Fig. 1) which contains key species of invertebrates (Table 1) including infiltrated wildwood relicts.

THE HISTORY OF ANTHROPOGENIC IMPACTS

Historical human impacts created much of the existing invertebrate interest at Mill Bank. The sometimes unqualified concept of 'rewilding' has no relevance. Of direct relevance are issues of sustainability in a managed relationship between humankind, invertebrates and the wider biota over time *sensu* Williamson (2003, 2022). Management, or more importantly consistent management, sustains and enhances biodiversity (Pullin, 1997) and it is this that underpins the biota of Mill Bank.

Documents, covering the period from *ca*AD1400 to AD1900, held by the National Library of Wales at Aberystwyth and by the Gwent Archives at Ebbw Vale have been consulted. A medieval fishpond or Vishpol, a little upstream of Mill Bank was first recorded in AD1295. A mill termed 'the water mill of the Lord' was recorded in AD1433 at the death of the widow of Sir Edmund Mortimer, the Earl of March and Lord of the Manor of Trellech (1376-1409). This corn mill (Tucker, 1971b) situated 200 m downstream of the fishpond dam (Probert, 1958) is believed to have occupied the site of the present barn (Fig. 2, left of centre). The miller was the first known resident of Mill Bank.

Archaeological and visible evidence of settlement suggests that human occupation of Mill Bank developed slowly by accretion after AD1600. Ceramic and glass sherds confirm early post-medieval human activity and a notched blade of sheet copper unearthed on 14 March 2018 may be early medieval. Early human encroachment into Blackbrook Wood at this time was limited by the difficult terrain and the enormous monoliths bedded into the lower valley slopes may be associated with this phase of clearance. Prior to 1790 clearings became the property of their occupants. The Badminton Estate map of 1779 shows that much of the land was then in the ownership of the Dukes of Beaufort (the fifth Duke of Beaufort was appointed Lord Lieutenant of Monmouthshire in 1771) and the Badminton Estate. Importantly for the historical development of the entomofauna this map confirms

that Mill Bank then had much more extensive traditional orcharding than at the present time, and that a large area, including what is now the Hayfield, was maintained as a pasture orchard. Much of the orchard entomofauna known today would have been established by then as would the cottage economy that contributed to invertebrate biodiversity.

Following the Trellech Enclosures Act of 1810 areas of 'waste' were set aside for sale by the enclosure commissioners to defray the cost of overseeing enclosure. At Mill Bank plots were allocated to 'those who raised millstones' from its outcrop which were then renowned throughout Wales. Thomas Watkin, a millstone fabricator, built a cottage and pig-cott on the Top Field, the remnants of which are still visible. The impacts of this rural industry still influence the extant entomology having created hillside gullies where the millstones were rolled down to the River Wye and veneers of sand that created conditions perfect for many species of aculeate Hymenoptera. Relict insects of this exposed sediment-rich land surface persist today and include the scarce staphylinid beetle *Scopaeus sulcicollis* (Stephens, 1833) and the rare cryptophagid beetle *Atomaria rubricollis* Brisout de Barneville, 1863. The net result of these historical impacts can be observed clearly in Figs 2 and 3. The northern pasture orchard consists of stone fruit trees mostly less than 70 years old and the southern pasture orchards, Orchard Field and Isaac's Field (Fig. 2), consist largely of pome fruit trees, the oldest being some 200 years of age. It is of passing interest that prior to the establishment of this historical framework the author anticipated that the entomofauna of Mill Bank encapsulated at least 1000 years of history.

It is against this background that Mr I. P. Rabjohns, the present owner of Mill Bank, has maintained aspects of traditional management through extensive grazing and orcharding systems and practices, sympathetic mowing and traditional hay-making thus sustaining a nationally significant invertebrate population mosaic of considerable historic significance. The Oil Beetle *Meloe rugosus* Marsham, 1802 and other invertebrates of conservation interest (Rabjohns & Whitehead, 2022; Whitehead, 2022a) are intimately connected with this traditional management. Since *M. rugosus* was first described new to Wales from Mill Bank (Rabjohns, 2007) more than 650 examples of this beetle have been observed there, a remarkable liaison between humankind and an insect. Table 1 relates 136 species of invertebrate to a range of habitats with varying levels of management. Table 2 illustrates the role of management in sustaining 90 species of insect that are generally regarded as scarce in Wales.

DEFINITIONS

British or GB rarity statuses are now limited to Nationally Rare NR which normally equates to a presence, usually of breeding populations, in up to 15 British Ordnance Survey map hectads since 1990. Nationally Scarce NS status equates to a presence in from 16 to 100 British Ordnance Survey map hectads since 1990. Species of Principal Importance listed under Sections 41 (England) and 42 (Wales) of the NERC Act 2016 align closely and Section 42 species were subsequently all reconfirmed under the terms of the Environment (Wales) Act 2016. Since the VC has England as its eastern boundary both Sections of the Act are cited here. IUCN international rankings relate to levels of threat e.g. risk of extinction (Mace & Lande, 1991) and are rarely considered here. Vice-county is referred to by the contraction VC. Amongst Coleoptera the downgrading of Silphidae to Silphinae within Staphylinidae (Cai, *et al.*, 2022) may yet be unfamiliar generally and is not employed here. With a few minor exceptions nomenclature and phylogenetic sequence follows Agassiz *et al.* (2013) for Lepidoptera; Duff (2018) for Coleoptera; Sharkey (2007) for Hymenoptera together with Broad & Shaw (2016), Johansson & Cederberg (2019) and Tschopp *et al.* (2016). Plant nomenclature follows Stace (2022).

DEFINING MONMOUTHSHIRE

An administrative county of Monmouthshire, governed by an elected county council, was formed in 1889 under the terms of the Local Government Act 1888. This was abolished in 1974 under the Local Government Act 1972, when it became the county of Gwent, itself abolished in 1996 under the Local Government (Wales) Act 1994. Administration was then transferred to five districts of which one was Monmouth, a land area covering 60% of the former historic county of Monmouthshire that was established in 1535. The unitary authority of Monmouth presently covers Mill Bank.

Monmouthshire clearly has a complex history (Hopkins, 1991) which has resulted in some vagueness in the entomological literature. The Monmouth unitary area is managed by Monmouthshire County Council although

it clearly does not represent a county. This led Anthony (2021, p. 2) to differentiate between Monmouthshire and Gwent Lepidoptera records; in this case Monmouthshire referring neither to Watsonian VC35 nor to the county but instead to the area comprising the current unitary authority. Horton (1994) titled and subtitled his publication "*Monmouthshire Lepidoptera: the butterflies and moths of Gwent*", Gwent hitherto being the administrative county. However his boundary descriptions (p. 12) imply that it is VC boundaries that are followed and on p. 27 it is stated that: "*where it is a new county record it is usually stated thus, 1st v-c. rec.*" Horton's description of the western boundary is also that of the VC boundary so that his usage of 'Monmouthshire' is here held to be that of the VC *i.e.* VC35. The curtilage of the land area occupied by the VC is almost identical to that occupied by the historic county. In the present account any reference to county implies the Watsonian VC.

THE INVERTEBRATE FAUNA BACKGROUND INFORMATION

Assessment of invertebrate biodiversity may include a wide range of active and passive techniques. Comprehensive as the current data are, particularly over time, they would doubtless have been extended by the use of actively-monitored passive trapping techniques such as pitfall, subterranean, flight interception and malaise traps. The work involved in processing such additional data could not be countenanced and it is reasoned that the existing data trawl provides adequate grounds for discussion. When Owen (1991) recorded 529 species of ichneumonid wasps in her suburban Leicestershire garden heavy reliance was placed on the expertise of North American taxonomists. Additionally, when the finer details of trapping methodologies were examined, for example within variations of malaise traps (Uhler *et al.*, 2022), their efficacy was found to vary considerably.

This account focuses on data gleaned by active searching, Mercury Vapour (MV) light trapping and limited interceptive vane trapping by the author and by Mr Rabjohns. It is likely therefore that this account somewhat understates the bioconservation interest of Mill Bank and certainly some groups remain less well-known. For example Diptera are represented by only 64 species in 26 families although they include the Western Bee Fly *Bombylius canescens* (Mikan, 1796) (Fig. 15:2), the Nationally Scarce *Clusia tigrina* (Fallén, 1820) with two VC records and *Liancalus virens* (Scopoli, 1763) with five VC records. Many groups remain under-recorded generally. The chironomid midge *Microtendipes pedellus* (DeGeer, 1776) that came to MV light on 18 October 2015 has only six documented VC records while the aphid *Euceraphis betulae* (Koch, 1835) observed on Silver Birch *Betula pendula* Roth on 20 April 2017 appears to be unrecorded in Wales (NBN atlas accessed 2 February 2023). Clearly there is still much to discover about the entomofauna of Wales.

Key data relates macroinvertebrates to defined areas of land use and management (Table 1) and provides additional information for selected species of Psocoptera (nine families, 20 species), Lepidoptera (712 species), Coleoptera (56 families, 469 species, 6984 individuals examined) and Hymenoptera (18 families, 119 species). The tables and figures (e.g. Figs 4, 10, 15) provide further information on other groups, for example Hemiptera (25 families, 131 species) and highlight the diversity and changed or changing status of species. Data-gathering spans more than two decades and accounts for 39685 individual insect observations and 1304 other invertebrate observations including such interesting species as the Arctic Field Slug *Deroceras agreste* (Linnaeus, 1758) (Table 1). Most of the data on invertebrates other than Lepidoptera were generated between 2010 and 2020.

There is an important caveat on Welsh status ascriptions. The country has a vast range of habitats and is dominated by a largely mountainous and upland core comprising Snowdonia, the Cambrian Mountains and the Brecon Beacons. Species that appear from the tables to be rare in Wales may simply be limited by the overarching influences of topography and climate; a matter which has the potential not only to inform but also to enhance the significance of the findings presented here. Although the entomofauna of Mill Bank has highly individualised characteristics it is likely that its wider geographic affinity is in large measure anglicised and lies to the east and north-east.

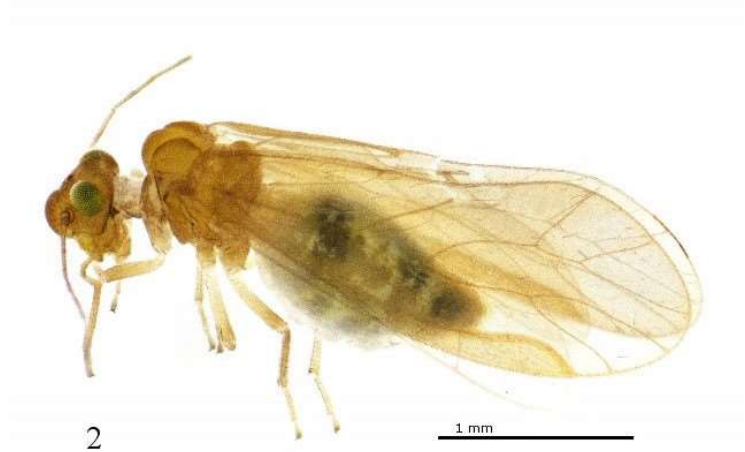


Fig. 4. Insect diversity at Mill Bank. 1. The bush-cricket *Conocephalus fuscus* (Fabricius, 1793), Flowery Bank, 2 September 2019; 2. The scarce elipsocid *Cuneopalpus cyanops*, 21 September 2021; 3. The auchenorrhynchan *Ledra aurita* Linnaeus, 1758, 26 June 2017, breeding on Hazel *Corylus avellana* L.; 4. The cydnid bug *Tritomegas bicolor* (Linnaeus, 1758), Flowery Bank, 1 September 2019; 5. A teneral raphidiid *Atlantoraphidia maculicollis* (Stephens, 1836) on its host tree *Larix kaempferi* (Lamb.) Carrière, 20 April 2017; 6. The ground beetle *Carabus monilis* a declined predator and habitat quality indicator traditionally of humid grasslands as here on 9 July 2013.

TABLE 1. SELECTIVE LIST OF 136 SPECIES OF INVERTEBRATES OF INTEREST OBSERVED AT MILL BANK BETWEEN 2011 AND 2022 INCLUSIVE IN RELATION TO NINE MANAGED LAND AREAS. OF THESE 78 (57%) ARE LIMITED TO ONE LAND AREA, 12 (9%) OCCUR IN FOUR OR MORE LAND AREAS AND 65 (48%) OCCUR IN THE HAYFIELD AND FLOWERY BANK. EMBOLDENED SPECIES NAMES IMPLY PARTICULAR SIGNIFICANCE.

+ breeding confirmed c compost h hay shed	House garden walls	Orchards	Pasture northern	Hayfield	Flowery Bank	Pwll-Mawr (<i>Larix</i>)	Blackbrook wood and edges	Riparian woodland & monoliths	Black Brook & monoliths
Archaeognatha: bristletails									
<i>Dilta hibernica</i> (Carpenter, 1907)	✓+					✓+ rocks			
Isopoda: woodlice									
<i>Porcellio spinicornis</i> Say, 1818	✓								
Myriapoda, Diplopoda: millipedes									
<i>Brachychaeteuma melanops</i> Brade-Birks & Brade-Birks, 1918		✓							
<i>Hylebainosoma nontronensis</i> Mauriès & Kime, 1999							✓		
<i>Cylindroiulus caeruleocinctus</i> (Wood, 1864)	✓+								
<i>Melogona scutellaris</i> (Ribaut, 1913)							✓	✓	
<i>Leptoïulus belgicus</i> (Latzel, 1844)	✓								
Odonata: dragonflies									
<i>Cordulegaster boltonii</i> (Donovan, 1807)	✓ in flight								✓+
Orthoptera: grasshoppers and crickets									
<i>Tetrix undulata</i> (Sowerby, 1806)	✓								
Dermaptera: earwigs									
<i>Forficula lesnei</i> (Finot, 1887)	✓				✓			✓	✓
<i>Labia minor</i> (Linnaeus, 1758)				✓c					
Psocoptera: 'barkflies'									
<i>Pteroxanium kelloggi</i> (Ribaga, 1905)	✓	✓	✓	✓ch	✓				
<i>Philotarsus picicornis</i> (Fabricius, 1793)	✓								
Hemiptera: true bugs									
<i>Nysius huttoni</i> F. B. White, 1878	✓								
<i>Nysius senecionis</i> (Schilling, 1829)	✓								
<i>Stygnocoris sabulosus</i> (Schilling, 1829)	✓+				✓+				✓+
<i>Trapezonotus dispar</i> Stal, 1873	✓+			✓+					
<i>Coriomeris denticulatus</i> (Scopoli, 1763)	✓+								

+ breeding confirmed c compost h hay shed	House garden walls	Orchards	Pasture northern	Hayfield	Flowery Bank	Pwll-Mawr (<i>Larix</i>)	Blackbrook wood and edges	Riparian woodland & monoliths	Black Brook & monoliths
<i>Myrmus miriformis</i> (Fallén, 1807)					✓				
<i>Eurygaster testudinaria</i> (Geoffroy, 1785)					✓+			✓	
<i>Piezodorus lituratus</i> (Fabricius, 1794)	✓								
<i>Eysarcoris venustissimus</i> (Schrank, 1776)	✓+								
<i>Acertropis gimmerthali</i> (Flor, 1860)			✓	✓+	✓				
<i>Stenotus binotatus</i> (Fabricius, 1794)				✓+	✓				
<i>Heterocordylus genistae</i> (Scopoli, 1763)	✓+								
<i>Pachytomella parallela</i> (Meyer-Dür, 1843)		✓	✓+	✓	✓+				
<i>Agallia consobrina</i> Curtis, 1833	✓+								
<i>Anoscopus flavostriatus</i> (Donovan, 1799)					✓				
<i>Anoscopus serratulae</i> (Fabricius, 1775)			✓	✓					
<i>Speudotettix subfuscus</i> (Fallén, 1806)	✓+								
<i>Issus coleoptratus</i> (Fabricius, 1781)	✓+						✓+		
<i>Arytainilla spartiophila</i> (Förster, 1848)	✓+								
<i>Cacopsylla visci</i> (Curtis, 1835)		✓+							
Neuroptera: lacewings and snake flies									
<i>Atlantoraphidia maculicollis</i> (Stephens, 1836)						✓+			
<i>Xanthostigma xanthostigma</i> (Schummel, 1832)	✓	✓	✓+ <i>Juglans</i>		✓				
Lepidoptera: butterflies and moths									
<i>Zygaena filipendulae</i> (Linnaeus, 1758)	✓MV			✓					
<i>Zygaena lonicerae</i> (Scheven, 1777)	✓MV			✓					
<i>Agapeta zoegana</i> (Linnaeus, 1767)					✓+				
<i>Tortrix viridana</i> Linnaeus, 1757							✓+		
<i>Thymelicus lineola</i> (Ochsenheimer, 1808)				✓	✓				
<i>Speyeria aglaja</i> (Linnaeus, 1758)	✓+			✓					
<i>Argynnis paphia</i> (Linnaeus, 1758)	✓						✓		
<i>Melanargia galathea</i> (Linnaeus, 1758)	✓				✓+				
<i>Euclidia mi</i> (Clerck, 1759)				✓					
Coleoptera: beetles									

+ breeding confirmed c compost h hay shed	House garden walls	Orchards	Pasture northern	Hayfield	Flowery Bank	Pwll-Mawr (<i>Larix</i>)	Blackbrook wood and edges	Riparian woodland & monoliths	Black Brook & monoliths
<i>Gyrinus urinator</i> Illiger, 1807									✓
<i>Leistus rufomarginatus</i> (Duftschmid, 1812)						✓			
<i>Carabus violaceus</i> Linnaeus, 1758	✓	✓	✓	✓		✓+	✓		
<i>Asaphidion curtum</i> (Heyden, 1870)									✓
<i>Synuchus vivalis</i> (Illiger, 1798)					✓				
<i>Perigona nigriceps</i> (Dejean, 1831)				✓c					
<i>Agathidium varians</i> Beck, 1817								✓	
<i>Silpha tristis</i> Illiger, 1798	✓+		✓+	✓+					
<i>Xylodromus concinnus</i> (Marsham, 1802)				✓ch					
<i>Bryaxis curtisii</i> (Leach, 1817)			✓	✓	✓			✓	
<i>Sepedophilus bipunctatus</i> (Gravenhorst, 1802)								✓+	
<i>Tachyporus atriceps</i> Stephens, 1832					✓+			✓	
<i>Ocalea picata</i> (Stephens, 1832)								✓	
<i>Crataraea suturalis</i> (Mannerheim, 1830)	✓ in flight			✓+h					
<i>Myllaena infuscata</i> Kraatz, 1853									✓
<i>Leptusa ruficollis</i> (Erichson, 1839)						✓			
<i>Atheta harwoodi</i> Williams, 1930				✓c					
<i>Atheta hypnorum</i> (Kiesenwetter, 1850)					✓		✓+		
<i>Atheta excellens</i> (Kraatz, 1856)					✓				
<i>Trichiusa immigrata</i> Lohse, 1984				✓c					
<i>Ochtheophilus andalusiacus</i> (Fagel, 1957)									✓
<i>Carpelimus erichsoni</i> (Sharp, 1871)				✓c					
<i>Stenus flavipes</i> Stephens, 1833					✓				
<i>Rugilus similis</i> (Erichson, 1839)					✓				
<i>Heterothops praeivus</i> Erichson, 1839				✓h					
<i>Philonthus debilis</i> (Gravenhorst, 1802)				✓c					
<i>Philonthus discoideus</i> (Gravenhorst, 1802)				✓c					
<i>Anoplotrupes stercorosus</i> (Scriba, 1791)							✓		
<i>Hoplia philanthus</i> (Fuessly, 1775)	✓+	✓+	✓+						

+ breeding confirmed c compost h hay shed	House garden walls	Orchards	Pasture northern	Hayfield	Flowery Bank	Pwll-Mawr (<i>Larix</i>)	Blackbrook wood and edges	Riparian woodland & monoliths	Black Brook & monoliths
<i>Calyptomerus dubius</i> (Marsham, 1802)				✓c h					
<i>Agrypnus murinus</i> (Linnaeus, 1758)	✓+								
<i>Lampyris noctiluca</i> (Linnaeus, 1758)	✓+		✓+						
<i>Malthinus seriepunctatus</i> Kiesenwetter, 1852						✓			
<i>Cryptophagus scutellatus</i> Newman, 1834				✓h					
<i>Atomaria apicalis</i> Erichson, 1846				✓c	✓				
<i>Atomaria rubella</i> Heer, 1841				✓	✓		✓	✓	
<i>Genistogethes carinulatus</i> (Förster, 1849)	✓				✓				
<i>Rhyzobius chrysomeloides</i> (Herbst, 1792)	✓								
<i>Subcoccinella 24-punctata</i> (Linnaeus, 1758)	✓		✓	✓	✓+		✓	✓	
<i>Mordellistena pumila</i> (Gyllenhal, 1810)	✓+								
<i>Pyrochroa coccinea</i> (Linnaeus, 1761)		✓					✓+	✓	
<i>Rhagium bifasciatum</i> Fabricius, 1775								✓+	
<i>Cryptocephalus labiatus</i> (Linnaeus, 1760)					✓+				
<i>Oomorpha concolor</i> (Sturm, 1807)	✓							✓+	
<i>Cassida vibex</i> Linnaeus, 1767					✓+				
<i>Prasocuris marginella</i> (Linnaeus, 1758)	in flight	bits cavity	✓+		✓+				
<i>Chrysolina staphylaea</i> (Linnaeus, 1758)					✓				
<i>Chrysolina brunsvicensis</i> (Gravenhorst, 1807)					✓+				
<i>Apoderus coryli</i> (Linnaeus, 1758)							✓+		
<i>Eutrichapion punctigerum</i> (Paykull, 1792)					✓				
<i>Synapion ebeninum</i> (Kirby, 1808)	✓								
<i>Protapion fulvipes</i> (Geoffroy in Fourcroy, 1785)	✓		✓					✓	
<i>Protapion nigrirtarse</i> (Kirby, 1808)					✓				
<i>Gymnetron melanarium</i> (Germar, 1821)	✓								
<i>Ceutorhynchus sulcicollis</i> (Paykull, 1800)								✓	
<i>Rhinoncus pericarpus</i> (Linnaeus, 1758)				✓	✓				
<i>Euophryum confine</i> (Broun, 1881)	✓ in flight	✓+		✓c h		✓+			
<i>Strophosoma melanogrammum</i> (Forster, 1771)	✓								

+ breeding confirmed c compost h hay shed	House garden walls	Orchards	Pasture northern	Hayfield	Flowery Bank	Pwll-Mawr (<i>Larix</i>)	Blackbrook wood and edges	Riparian woodland & monoliths	Black Brook & monoliths
<i>Barynotus moerens</i> (Fabricius, 1792)								✓	
<i>Sciaphilus asperatus</i> (Bonsdorff, 1785)	✓				✓				
<i>Andrion regensteinese</i> (Herbst, 1797)	✓+								
<i>Sitona ambiguus</i> (Gyllenhal, 1834)					✓				
<i>Sitona striatellus</i> Gyllenhal, 1834					✓				
<i>Caenopsis fissirostris</i> (Walton, J., 1847)	✓				✓	✓			
<i>Tropiphorus terricola</i> (Newman, 1838)	✓				✓				
<i>Leiosoma deflexum</i> (Panzer, 1795)	✓	✓		✓	✓		✓		
<i>Leiosoma deflexum</i> (Panzer, 1795) v. <i>collare</i> Rye, 1873					✓				
<i>Leiosoma oblongulum</i> (Panzer, 1795)				✓	✓				
Hymenoptera: bees wasps and ants									
<i>Enclisis alpicola</i> (Habermehl, 1926)	✓								
<i>Agriotypus armatus</i> Curtis, 1832									✓
<i>Stenammas debile</i> (Förster, 1850)								✓	
<i>Formica fusca</i> Linnaeus, 1758	✓+		✓+	✓+	✓				
<i>Formica lemmani</i> Bondroit, 1917		✓+							
<i>Sphecodes monilicornis</i> (Kirby, 1802)	✓+				✓				
<i>Bombus muscorum</i> (Linnaeus, 1758)	✓								
Diptera: flies									
<i>Bombylius canescens</i> (Mikan, 1796)	✓		✓						
<i>Urophora jaceana</i> (Hering, 1935)					✓+				
<i>Chrysotoxum festivum</i> (Linnaeus, 1758)	✓								
<i>Thecophora cinerascens</i> (Meigen, 1804)	✓								
<i>Sicus ferrugineus</i> (Linnaeus, 1761)				✓+					
<i>Myopa buccata</i> (Linnaeus, 1758)	✓								
<i>Rivellia syngenesiae</i> (Fabricius, 1781)				✓					
<i>Tephritis neesii</i> (Meigen, 1830)	✓+								
<i>Clusia tigrina</i> (Fallén, 1820)	✓								
Arachnida: spiders and harvestmen									

+ breeding confirmed c compost h hay shed	House garden walls	Orchards	Pasture northern	Hayfield	Flowery Bank	Pwll-Mawr (<i>Larix</i>)	Blackbrook wood and edges	Riparian woodland & monoliths	Black Brook & monoliths
<i>Ceratinella scabrosa</i> (O.P.-Cambridge, 1871)								✓	
<i>Anelasmacephalus cambridgei</i> (Westwood, 1874)	✓							✓	
<i>Sabacon viscayanum</i> Simon, 1881								✓	
<i>Homalenotus quadridentatus</i> (Cuvier, 1795)	✓				✓ wall				
Mollusca: slugs and snails									
<i>Arion vulgaris</i> Moquin-Tandon, 1855						✓+			
<i>Zenobiellina subrufescens</i> (Miller, 1822)	✓								
<i>Limax cinereoniger</i> Wolff, 1803						✓+	✓		
<i>Deroceras agreste</i> (Linnaeus, 1758)									✓+

TABLE 2. NINETY SPECIES OF INSECT KNOWN FROM MILL BANK BELIEVED TO HAVE LESS THAN 20 WELSH RECORDS (NBN ATLAS DATA ACCESSED NOVEMBER 2022)

Taxonomy * breeding confirmed	Mill Bank records	First site record	Welsh records	National status	Culture- favoured	Niche occupancy
Psocoptera: 'Barkflies'						
<i>Pteroxanium kelloggi</i> (Ribaga, 1905)*	101	05-07-2011	5		✓	Widespread
<i>Ectopsocus axillaris</i> (Smithers, 1969)	1	16-05-2012	1	NS	✓	Foliage <i>Cupressus</i>
<i>Cuneopalpus cyanops</i> (Rostock, 1876)	1	21-09-2021	1	NS	✓	Foliage <i>Cupressus</i>
<i>Reuterella helvimacula</i> (Enderlein, 1903)	1	20-08-2019	1	NS		Garden
<i>Philotarsus picicornis</i> (Fabricius, 1793)	1	21-09-2021	0	NR	✓	Foliage <i>Cupressus</i>
<i>Loensia variegata</i> (Latreille, 1799)	1	17-05-2012	3		✓	Bark <i>Larix</i>
Hemiptera: true bugs						
<i>Psyllopsis discrepans</i> (Flora, 1861)	1	13-04-2022	3	NS?		Tree <i>Salix</i>
<i>Arytainilla spartiophila</i> (Förster, 1848)*	7	19-06-2012	3			Garden <i>Sarothamnus</i>
<i>Trapezonotus dispar</i> Stal, 1873*	4	14-08-2013	4		✓	Garden (thermoxeric)
<i>Empicoris vagabundus</i> (Linnaeus, 1758)	2	12-08-2013	9			Foliage <i>Cupressus</i> etc
<i>Xylocoris galactinus</i> (Fieber, 1836)*	2	19-06-2012	4	Naturalised	✓	Compost
<i>Hypseloecus visci</i> (Puton, 1888)*	10	19-06-2012	0	NS	✓	Orchard
Lepidoptera: butterflies and moths						
<i>Antispila petryi</i> (Martini, 1899)	2	31-07-2018	0			Foliage <i>Thelycrania</i>

Taxonomy * breeding confirmed	Mill Bank records	First site record	Welsh records	National status	Culture-favoured	Niche occupancy
<i>Caloptilia cuculipennella</i> (Hübner, 1796)	2	20-01-2014	4	NS	✓	House
<i>Bedellia somnulentella</i> (Zeller, 1847)	1	25-09-2017	18			Foliage <i>Convolvulus</i>
<i>Agnoea flavifrontella</i> (Denis & Schiffermüller, 1775)	3	21-05-2015	4	NS		MV light
<i>Apraerema larseniella</i> (Gozmány, 1957)	1	28-06-2012	10			MV light
<i>Caryocolum junctella</i> (Douglas, 1851)	1	30-11-2015	4	NR	✓	House
<i>Spilonota laricana</i> (Heinemann, 1863)	1	30-07-2014	11			MV light
<i>Cydia illutana</i> (Herrich-Schaeffer, 1851)	1	20-06-2018	0	NR		MV light
<i>Cydia deshaisiana</i> (Lucas, 1858)	1	25-08-2019	0 (records exist)	Adventive	✓	MV light
<i>Pammene trauniana</i> (Denis & Schiffermüller, 1775)	1	20-06-2020	0	NR		Foliage <i>Acer campestre</i>
<i>Synanthedon myopaeformis</i> (Borkhausen, 1789)*	1	23-07-2013	3	NS	✓	Orchard
<i>Assara terebrella</i> (Zincken, 1818)	1	10-08-2012	1	NR		MV light
<i>Ephestia elutella</i> (Hübner, 1796)	1	20-06-2019	1	NS		MV light
<i>Eupithecia millefoliata</i> Rössler, 1866	1	05-07-2002	1	NS		MV light
<i>Trichopteryx polycommata</i> (Denis & Schiffermüller, 1775)	1	30-04-2002	1	NS		MV light
<i>Pachynemia hippocastanaria</i> (Hübner, 1799)	1	05-07-2002	1	NS		MV light
<i>Paracolax tristalis</i> (Fabricius, 1794)	1	23-06-2010	1	NS		MV light
<i>Catocala fraxini</i> (Linnaeus, 1758)	4	09-09-2020	0	NS		MV light
<i>Mythimna l-album</i> (Linnaeus, 1767)	4	30-10-2018	2	NS		MV light, in flight
<i>Meganola albula</i> (Denis & Schiffermüller, 1775)	1	12-07-2018	4			MV light
Coleoptera: beetles						
<i>Perigona nigriceps</i> (Dejean, 1831)	1	18-09-2013	3	Naturalised	✓	Compost
<i>Carcinops pumilio</i> (Erichson, 1834)	2	19-06-2012	17		✓	Compost
<i>Cilea silphoides</i> (Linnaeus, 1767)	1	12-07-2016	2		✓	Hay mouldy
<i>Aleochara discipennis</i> Mulsant & Rey, 1853	1	16-05-2021	7	NS	✓	Faeces <i>Ovis</i>
<i>Crataraea suturalis</i> (Mannerheim, 1830)*	>700	29-06-2013	3		✓	Hay
<i>Liogluta longiuscula</i> (Gravenhorst, 1802)	1	24-06-2015	19		✓	Hay decayed
<i>Atheta hypnorum</i> (Kiesenwetter, 1850)*	16	26-04-2016	13			Woodland
<i>Atheta excellens</i> (Kraatz, 1856)	1	23-08-2012	4		✓	Hay
<i>Mocyta negligens</i> (Mulsant & Rey, 1873)	1	10-09-2019	3	NR	✓	Hay

Taxonomy * breeding confirmed	Mill Bank records	First site record	Welsh records	National status	Culture-favoured	Niche occupancy
<i>Acrotona muscorum</i> (Brisout de Barneville, 1860)	1	16-05-2012	8			Foliage <i>Cupressus</i>
<i>Trichiusa immigrata</i> Lohse, 1984	7	22-07-2013	0		✓	Compost
<i>Scaphisoma boleti</i> (Panzer, 1793)	2	24-06-2015	17		✓	Wood fungoid
<i>Carpelimus erichsoni</i> (Sharp, 1871)	1	22-07-2013	0		✓	Compost (near brook)
<i>Medon apicalis</i> (Kraatz, 1857)	1	10-05-2016	0	NS		In flight
<i>Scopaeus sulcicollis</i> (Stephens, 1833)	8	16-05-2012	4	NS	Relict	Exposed sediments
<i>Rugilus similis</i> (Erichson, 1840)	2	19-06-2012	2	NR	?Relict	Grassland MG5
<i>Quedius lucidulus</i> Erichson, 1839	4	26-06-2017	0	Naturalised	✓	Hay mouldy
<i>Philonthus discoideus</i> (Gravenhorst, 1802)*	2	22-07-2013	2		✓	Compost
<i>Philonthus parvicornis</i> (Gravenhorst, 1802)	1	24-06-2015	4		✓	Hay mouldy
<i>Gnorimus nobilis</i> (Linnaeus., 1758)*	1	21-07-2021	0	NS	✓	Orchard
<i>Clambus punctulum</i> (Beck, 1817)	1	19-06-2012	14		✓	Compost
<i>Megatoma undata</i> (Linnaeus, 1758)	1	05-07-2022	3	NS	✓	Timber shed
<i>Cryptophagus ruficornis</i> Stephens, 1830	1	24-06-2015	3	NS		Orchard
<i>Monotoma bicolor</i> Villa & Villa, 1835	15	19-06-2012	10		✓	Hay shed
<i>Monotoma longicollis</i> Gyllenhal, 1827	4	19-06-2012	4		✓	Compost
<i>Henoticus serratus</i> (Gyllenhal, 1808)	2	18-06-2012	19		✓	Wood sawn <i>Larix</i>
<i>Atomaria strandi</i> (Johnson, 1967)	1	16-05-2012	1	NR		Grassland
<i>Atomaria rubricollis</i> Brisout de Barneville, 1863	1	02-09-2019	7	NR	Relict	Sandy sediment
<i>Brassicogethes matronalis</i> (Audisio & Spornraft, 1990)*	46	07-06-2014	0	NR	✓	Inflorescence <i>Hesperis</i>
<i>Rhyzobius chrysomeloides</i> (Herbst, 1792)	8	16-05-2012	0	Naturalised	✓	Garden (thermoxeric)
<i>Meloe rugosus</i> Marsham 1802*	593	20-11-2006	8	NS	✓Relict	Garden lawn, terraces
<i>Caenopsis fissirostris</i> (Walton, J., 1847)	3	17-05-2012	13	NS		Woodland <i>Larix</i>
<i>Hypera meles</i> (Fabricius, 1792)	1	01-09-2019	4	NS		Grassland
<i>Magdalis ruficornis</i> (Linnaeus, 1758)	3	09-07-2013	11		✓	Orchard
Hymenoptera: bees wasps and ants						
<i>Lagynodes pallidus</i> (Boheman, 1832)	1	17-05-2012	0			Grassland
<i>Belyta sanguinolenta</i> Nees, 1834	1	12-07-2016	0			Woodland edge
<i>Spilomicrus hemipterus</i> Marshall, 1868	1	01-09-2019	0			Wall base

Taxonomy * breeding confirmed	Mill Bank records	First site record	Welsh records	National status	Culture-favoured	Niche occupancy
<i>Basalys tuberculatus</i> (Kieffer, 1911)	1	01-09-2019	0			Wall base
<i>Netelia infractor</i> Delrio, 1971	1	25-09-2017	1			MV light
<i>Netelia virgata</i> (Geoffroy, 1785)	2	25-09-2017	0			MV light
<i>Agriotypus armatus</i> Curtis, 1832	1	17-05-2012	14	NS		Riparian
<i>Gelis melanocephalus</i> (Schrank, 1781)	1	13-04-2022	0			Woodland broadleaved
<i>Gelis proximus</i> (Förster, 1850)	1	20-09-2019	0		✓	Hay
<i>Gelis spurius</i> (Förster, 1850)	6	23-08-2012	0		✓	Hay
<i>Enclisis alpicola</i> (Habermehl, 1926)	1	20-08-2019	0	NR		Garden thermoxeric
<i>Opheltes glaucopterus</i> (Linnaeus, 1758)	1	08-10-2021	3			MV light
<i>Ophion luteus</i> (Linnaeus, 1758) s.str.	1	23-04-2014	0			MV light
<i>Ophion mocsaryi</i> Braun, 1889	3	29-06-2021	0			MV light
<i>Ophion tenuicornis</i> Jansson, 2019	1	06-11-2021	0			MV light
<i>Stauropoctonus bombycivorus</i> (Gravenhorst, 1829)	2	25-09-2017	3			MV light
<i>Barylypa propugnator</i> (Förster, 1855)	1	12-07-2016	0		✓	Grassland
<i>Ichneumon extensorius</i> Linnaeus, 1758	1	14-10-2016	5			In flight
<i>Diphyus quadripunctorius</i> (Müller, 1776)	1	30-06-2021	1			In flight
<i>Stenamma debile</i> (Förster, 1850)	1	13-04-2022	7			Woodland broadleaved
<i>Lasius platythorax</i> Seifert, 1991*	nest	02-09-2019	18		✓	Wall base
<i>Dipogon subintermedius</i> (Magretti, 1886)	1	19-05-2022	15		✓	Orchard
Diptera: flies						
<i>Simulium angustitarse</i> (Lundström, 1911)*	1	06-03-2020	12			In flight
<i>Thecophora cinerascens</i> (Meigen, 1804)	1	10-09-2019	0	NR		<i>Lasioglossum</i> colony

OBSERVATIONS ON SELECTED ORDERS OF INSECTS

PSOCOPTERA: 'BARKFLIES'

TABLE 3. ATTRIBUTES OF 20 SPECIES OF PSOCOPTERA RECORDED AT MILL BANK BETWEEN 2011 AND 2022

Species	UK status	Ecology	Welsh records	VC records	Mill Bank records	Mill Bank niche
Lepidopsocidae						
<i>Pteroxanium kelloggi</i> (Ribaga, 1905)	Uncommon	Litter	5	0	101	Eurytopic
Trogidae						
<i>Cerobasis guestfalica</i> (Kolbe, 1880)	Common	Eurytopic	9	0	2	<i>Quercus robur</i>
Epipsocidae						
<i>Bertkauia lucifuga</i> (Rambur, 1842)	Scarce	Litter, arboreal	0	0	3	Rock pile Wood pile
Caeciliusidae						
<i>Caecilius fuscopterus</i> (Latreille, 1799)	Uncommon	Arboreal	9	1	2	<i>Frangula alnus</i>
<i>Epicaecilius pilipennis</i> (Lienhard, 1996)	Uncommon	Litter, Arboreal	1	0	2	<i>Larix Pyrus</i> fallen wood
Stenopsocidae						
<i>Graphopsocus cruciatus</i> (Linnaeus, 1768)	Common	Panarboreal Arbuscular	33	3	3	<i>Betula</i> <i>Fraxinus</i> foliage
<i>Stenopsocus immaculatus</i> (Stephens, 1836)	Common	Panarboreal	0	0	5	<i>Malus Pyrus</i> crown
<i>Stenopsocus stigmaticus</i> (Imhoff & Labram, 1846)	Uncommon	Arboreal	5	2	4	<i>Euonymus europaeus</i> L.
<i>Ectopsocus axillaris</i> (Smithers, 1969)	Uncommon	Arboreal	1	0	1	<i>Cupressus lawsoniana</i> cf. 'Stewartii'
<i>Ectopsocus briggsi</i> McLachlan, 1899	Common	Eurytopic	0	0	11	<i>Corylus</i> catkins
<i>Ectopsocus petersi</i> Smithers, 1978	Common	Arboreal	4	22	1	<i>Malus domestica</i>
Elipsocidae						
<i>Cuneopalpus cyanops</i> (Rostock, 1876)	NS Uncommon	Arboreal Coniferae	1	0	1	<i>Cupressus lawsoniana</i> cf. 'Stewartii'
<i>Elipsocus hyalinus</i> (Stephens, 1836)	Common		12	4	1	<i>Pyrus</i> fallen wood
<i>Reuterella helvimacula</i> (Enderlein, 1903)	NS Uncommon	Arboreal	1	0	1	Under timber
Philotarsidae						
<i>Philotarsus parviceps</i> Roesler, 1954	Common	Panarboreal	6	0	1	<i>Cupressus lawsoniana</i> cf. 'Stewartii'
<i>Philotarsus picicornis</i> (Fabricius, 1793)	NR scarce	Arboreal Coniferae	0	0	1	<i>Cupressus lawsoniana</i> cf. 'Stewartii'
Mesopsocidae						
<i>Mesopsocus immunis</i> (Stephens, 1836)	Uncommon	Panarboreal	13	2	14	<i>Prunus, Pyrus,</i> <i>Corylus</i>
Psocidae						
<i>Loensia fasciata</i> (Fabricius, 1787)	Uncommon	Panarboreal	6	0	3	<i>Pyrus</i> crown wood
<i>Loensia variegata</i> (Latreille, 1799)	Uncommon	Panarboreal	3	0	1	<i>Larix kaempferi</i>
<i>Psococerastis gibbosa</i> (Sulzer, 1776)	Uncommon	Panarboreal	10	2	2	<i>Pyrus</i> crown

Psocoptera or barkflies are represented by 20 species in nine families recorded between 2011 and 2022. Sixteen species are normally arboreal often as generalists in association with lichens (Table 3) and *Graphopsocus cruciatus* (Linnaeus, 1978) is commonly arbuscular. *Ectopsocus briggsi* McLachlan, 1899 is eurytopic and widespread; in England it is able to disperse in flight and reproduce throughout the winter. *Bertkauia lucifuga* (Rambur, 1842) and *Epicaecilius pilipennis* (Lienhard, 1998) occur terrestrially in sheltered damp niches (Whitehead, 2003a, 2003b), sometimes in near-darkness. In Worcestershire *E. pilipennis* may reproduce throughout the winter in sheltered microhabitats (PFW, pers. obs.). *Pteroxanium kelloggi* (Ribaga, 1905) is usually terrestrial although it may occur under loosened tree bark; in Worcestershire a breeding population of over 90 individuals was found on 28 November 2011 in darkness in a large bag containing dead twigs and foliage of the shrub *Escallonia* 'Ivey'. *Cuneopalpus cyanops* (Rostock, 1876) (Fig. 4:2) and *Philotarsus picicornis* (Fabricius, 1793) share a marked affinity for coniferous trees.

When the Welsh records of these species were cross-checked against NBN atlas data (on 9 January 2023) it was clear that the group was significantly under-represented or unevenly-represented on that platform given that species such as *E. briggsi* are largely ubiquitous. In the same way, whilst *P. kelloggi* may well be favoured by the Mill Bank microclimate, it cannot possibly represent c95% of the Welsh population (Table 3) especially since it is a cosmopolitan species (New, 1974). It is noted however that three of the four species occurring on Lawson's Cypress *Cupressus lawsoniana* (A. Murray bis) are believed to be uncommon in Britain even though New (1974) stated that *C. cyanops* may occur commonly.

Many of these species occur widely in the West Palaearctic, often in more than 20 countries (Lienhard, 1998) and *Reuterella helvimacula* (Enderlein, 1903) has a Holarctic distribution. *Pteroxanium kelloggi* is occidental in Europe preferring the Atlantic fringe while *Ectopsocus axillariss* (Smithers, 1969) was described from the Antipodes. It is noted that *Stenopsocus stigmaticus* (Imhoff & Labram, 1846) has occurred only on Spindle Tree *Euonymus europaeus* L. at Mill Bank.

LEPIDOPTERA: BUTTERFLIES AND MOTHS

According to Anthoney (2021) 50 species of butterflies and 589 species of macromoths occur in Monmouthshire. Bosanquet (2021) put the number of species of micromoths known from Monmouthshire at 855 at the end of 2020. Using the same end date the Lepidoptera of Mill Bank is represented by 29 species of butterflies, 394 species of macromoths and 289 species of micromoths, representing 58%, 67% and 34% respectively of the VC totals. These data are derived from specimens examined by Mr Rabjohns up until the end of 2020. Data-gathering became more intensive after 2000 and MV light-trapping began in 2002; these earlier data have been accounted for in Fig. 6. Prior to 2010 data was processed using a management system different to the present one. The trapping system was also different and trapping effort was sporadic with less attention given to micromoths.

Figures 5 and 6 consider numbers of species of macromoths on three spatial scales, the site, the VC and the country; comparable data for micromoths are unavailable because at Mill Banks it is species (Fig. 7) and not their number that have been recorded. These comparative figures should be perceived as broadly accurate but indicative. In 2010 the Mill Bank macromoth fauna comprised 35% of the VC species total at that time, ten years later it had risen to 58% (Fig. 5). The number of MV light-trapping sessions varied from 10 in 2010 and 2011 to 30 in 2018 and 2020. Between 2010 and 2020 inclusive the total number of trapping sessions amounted to 226 thus averaging c22 trapping sessions a year. The number of new species trapped *per annum* declined steadily from 36 in 2010 to eight in 2020; the number of such species unsurprisingly correlating with the number of trapping sessions. Amongst macromoths 54 species (14%) occurred in every year and 43 (11%) occurred in only one year. Such figures need to be considered carefully due to the many variables involved; changes in periodicity are not considered here. Further information on selected species of Lepidoptera is given in Table 5.

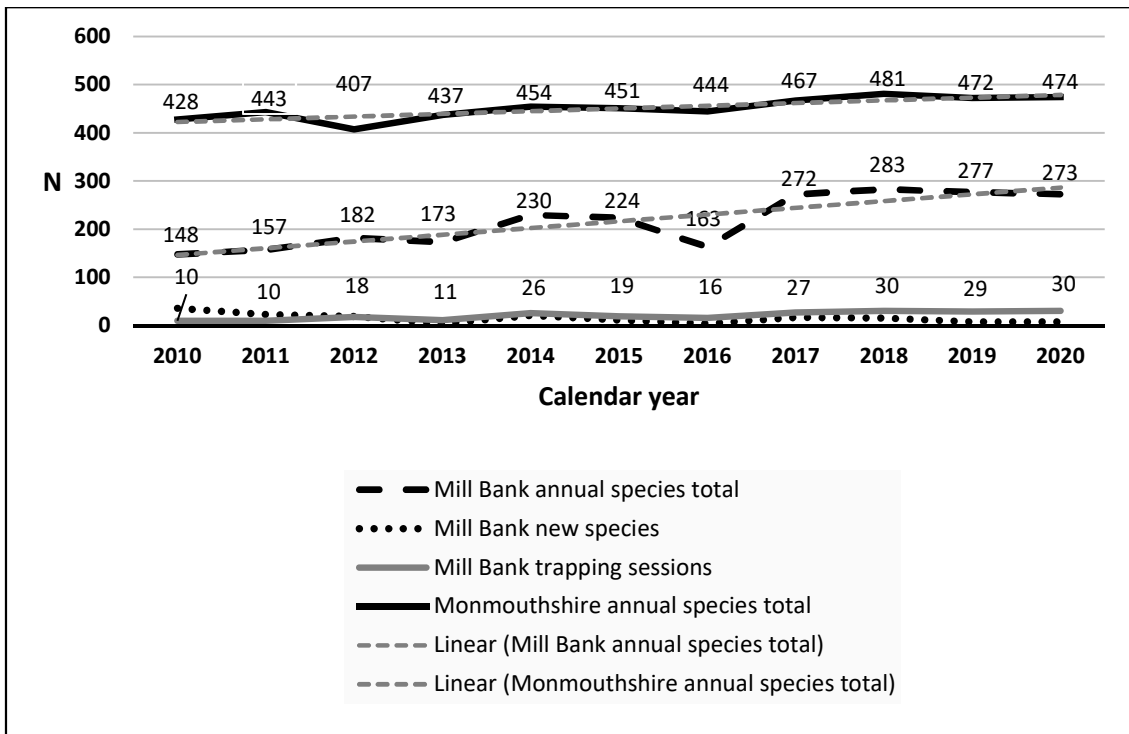


Fig. 5. The Mill Bank MV light trapping programme. Counts of macromoths from 2010 to 2020 inclusive compared with the same VC data.

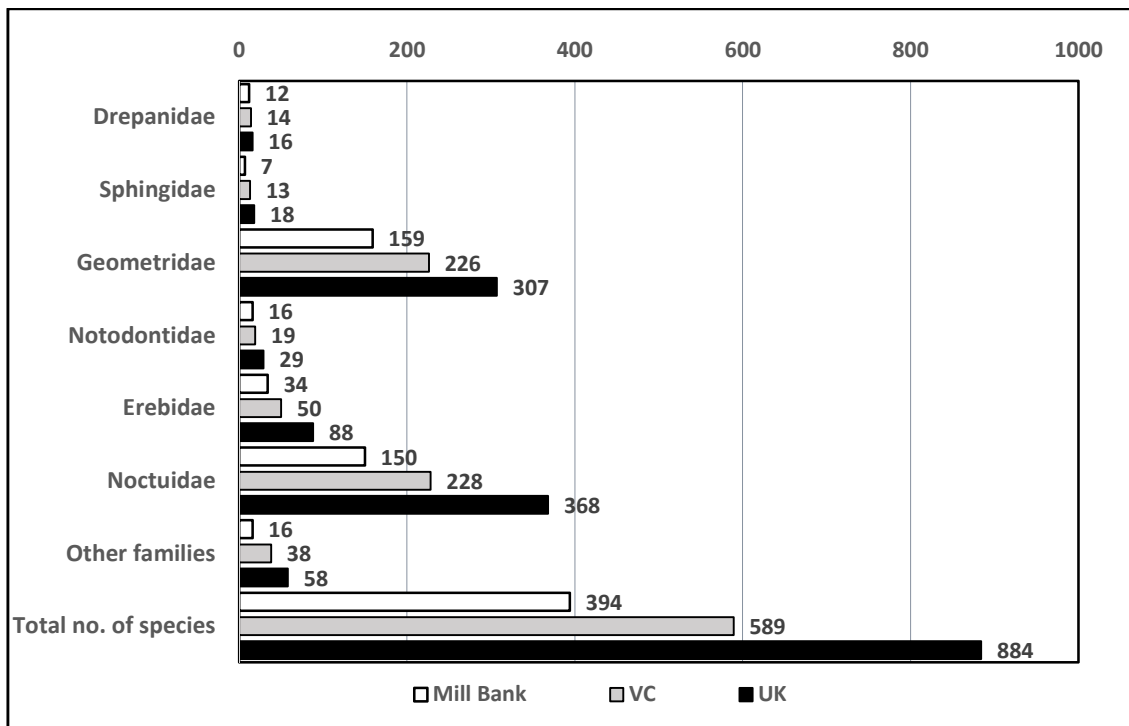


Fig. 6. Number of species of macromoths recorded at Mill Bank from 2000 to 2020 in relation to VC totals up to the end of 2020 (Anthony, 2021) and British totals at 2013 (Agassiz *et al.*).

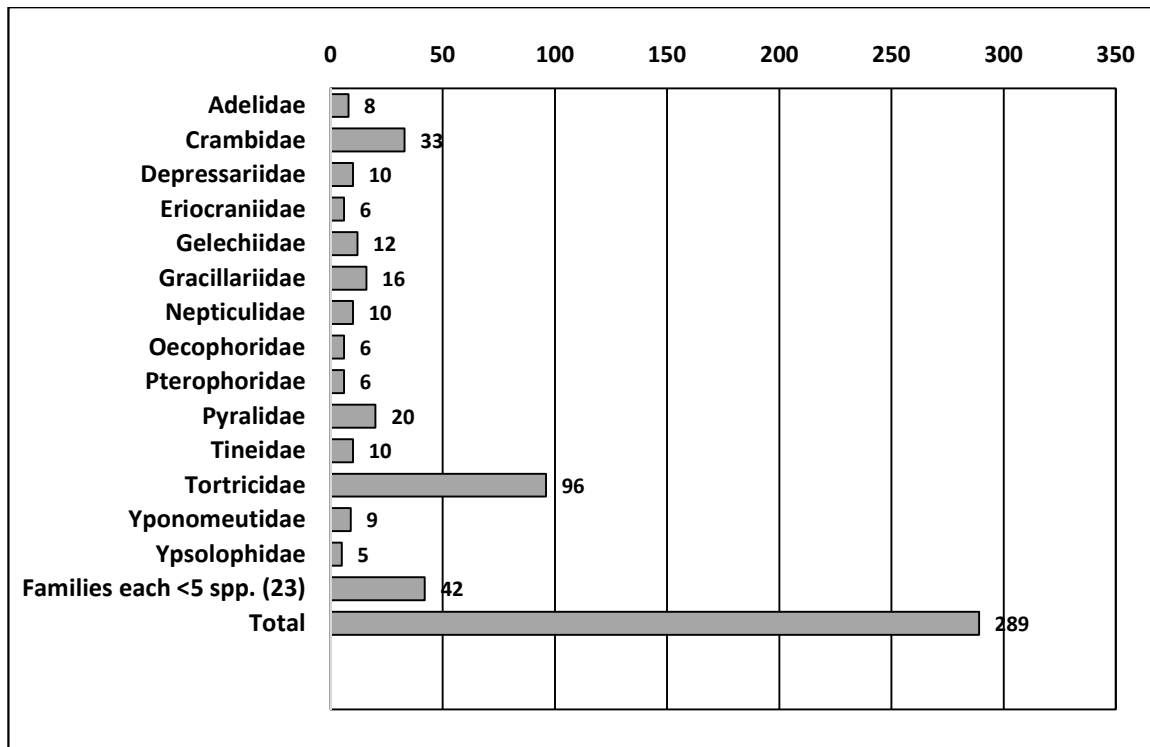


Fig. 7. Number of species of micromoths recorded at Mill Bank from 2010 to 2020. Table 5 provides further synoptic details for this group.

LEPIDOPTERA AND THE ISSUE OF SITE FIDELITY

Some useful information can be derived from the assemblage of 712 species of Lepidoptera. This is somewhat limited by a comparative lack of knowledge of larval stages although in certain instances larvae were identified before the adult stages were. One particularly telling finding is that the moth fauna is believed to provide an ecological fingerprint for the site and its environs and the reasoning for this is presented.

Of the 17895 macromoths examined only 19 or 0.1% are recognised migrants most of which occur regularly in Wales. The other 99.9% are believed to form a broadly autochthonous assemblage characterising the site, the valley side below and the Trellech ridge above. In a heavily-dissected landscape such as the Wye valley it would be no surprise if the regional moth fauna was composed of subsets of characteristic species in which coastal immigrants do not commonly figure.

The matter of faunal integrity and local fidelity may be further examined by the host-plant affinities of moths in relation to the vegetation of Mill Bank (Figs 8, 9) noting that the host-plants of seven species of macromoths are unconfirmed. Analyses of the woody plant species within the curtilage of Mill Bank demonstrates that those within Betulaceae (*Alnus*, *Betula*) comprise 22%, Rosaceae (*Malus*, *Prunus*, *Pyrus*, *Sorbus*) 21%, Oleaceae (*Fraxinus*) 14%, Fagaceae 5% and Salicaceae (*Populus*, *Salix*) 3% of the plants by number. Herbaceous vegetation, manifested by the historic clearances, is a feature of the Flowery Bank with an abundance of tall herbs especially Asterales, and of the Hayfield, Isaac's Field, Walnut Field, Top Field and Yard Bank with Poaceae dominant throughout, this varying through tall ungrazed canopies, pasture, mown sward and tussocks. When the 134 polyphagous species of moth are excluded (Fig. 9) a yet clearer impression of a localised residential moth fauna becomes apparent. The relationship between the large number of moths associated with Salicaceae and Fagaceae (Fig. 9) may appear somewhat anomalous but the volume of their tree crowns, especially of Pedunculate Oak *Q. robur*, needs to be accounted for together with the nearby woodland presence of that tree.

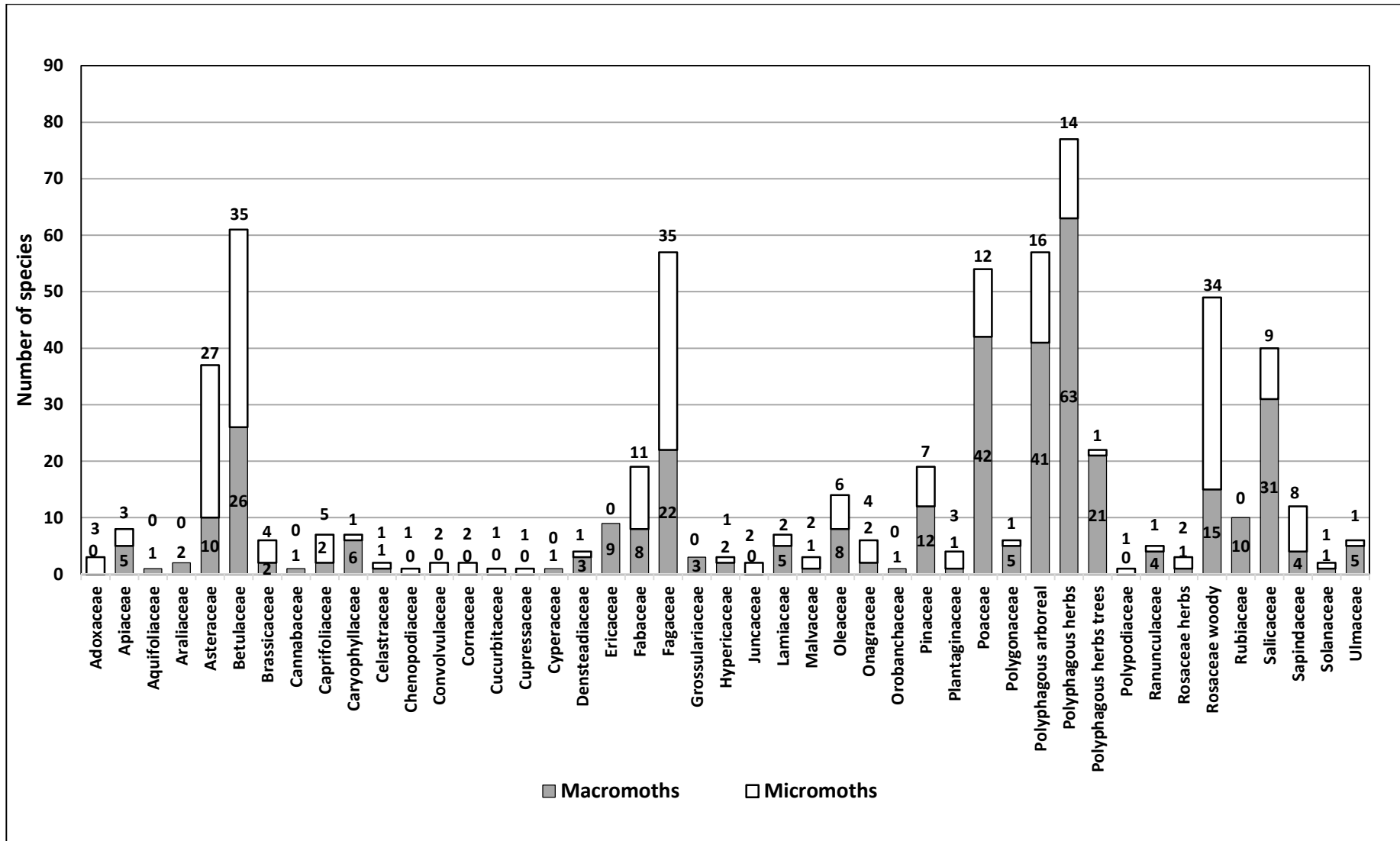


Fig. 8. Host plant affinities of 387 species of macromoths and 289 species of micromoths including polyphagous species recorded at Mill Bank between 2000 and 2020.

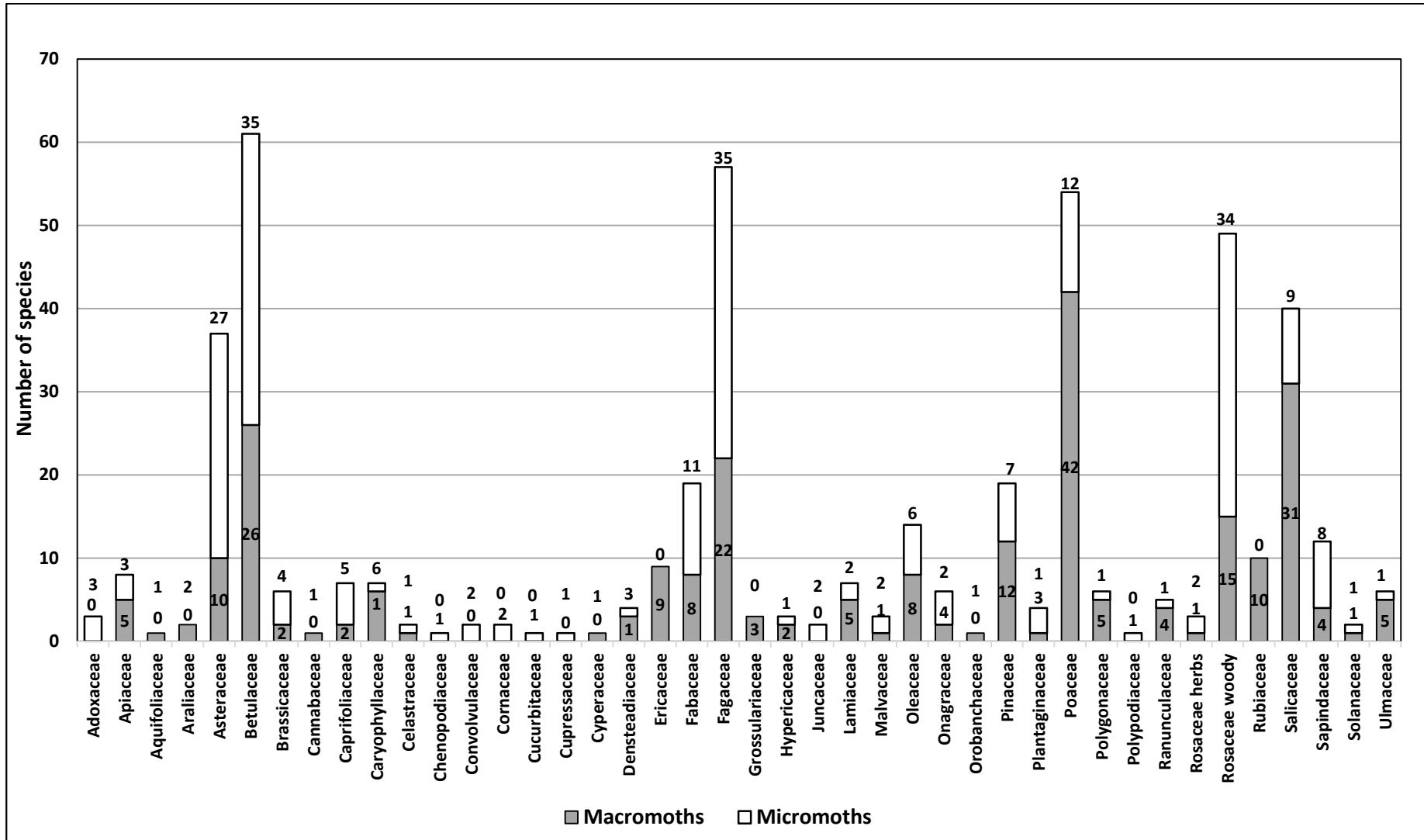


Fig. 9. Host plant affinities of 387 species of macromoths and 289 species of micromoths excluding polyphagous species recorded at Mill Bank between 2000 and 2020. These affinities extend over 41 host plant families of which 16 are dominantly woody and 25 dominantly herbaceous.

Other lines of evidence support the concept of faunal integrity and site fidelity. An ongoing light trapping programme within a kilometre of Mill Bank demonstrates similarities between the two moth faunas. Dr Stephanie Tyler MBE has trapped Lepidoptera at Yew Tree Cottage 979 m south of Mill Bank in a shallow gently descending valley. The landscape is largely pastoral in an irregular field system created from woodland clearances defined by boundaries approximating to linear woodland together with some small *remanié* blocks of woodland. Unlike Mill Bank there is no riparian woodland, far less climatic buffering and topographical diversity and reduced proximity to significant blocks of ancient woodland. Both sites share a limited number of presumably ‘ancient’ heathland moths that feed on species or cultivars of Ericaceae. Comparisons have been made between the most speciose families of macromoths from both sites (Table 4). These demonstrate that 82% of the Mill Bank macromoths occur at Yew Tree Cottage, the absentees frequently explained by the existence at Mill Bank of particular plant families and species e.g. Betulaceae, woody Fabaceae (*Ulex*, *Cytisus* spp.), Fagaceae (mature oak woodland), Pinaceae (established larch *Larix* woodland) and Salicaceae. The presence of these plants at Mill Bank may explain the absence at Yew Tree Cottage of 37 of the species accounted for in Table 4. It needs to be accepted that light trapping sessions at each site were not always synchronous and also that some distinctions do exist between the two assemblages, for example the more frequent occurrence of *Arctia caja* (Linnaeus, 1758) at Yew Tree Cottage.

TABLE 4. COMPARISON OF THE NUMBER OF SPECIES IN FOUR WELL-REPRESENTED FAMILIES OF MACROMOTHS AT MILL BANK AND YEW TREE COTTAGE ASSEMBLED BY MV LIGHT TRAPPING AT END OF 2020.

Family	Mill Bank	Yew Tree Cottage	Yew Tree Cottage species as percentage of Mill Bank species
Drepanidae	12	10	83%
Geometridae	159	126	79%
Erebidae	34	28	82%
Noctuidae	150	126	84%
All species	355	290	82%

It seems clear from Table 4 that the macromoth faunas from these two sites, even if the distribution of their larvae remain less understood, depict a diverse reasonably ‘old’ regional fauna which appears to be comparatively stable in time subject to the normal appearance of previously unrecorded species (Fig. 5). This concept is further supported by a well-expressed parasitoid fauna of nocturnal moth-specialising ichneumonid wasps. This includes four species of *Ophion*, four species of *Netelia* and notably the *Stauropus* parasitoid *Stauropoctonus bombycivorus* (Gravenhorst, 1829) (Table 7) believed to be associated with ancient woodlands and genuinely rare in Wales (NBN atlas accessed 31 January 2023). The possibility exists that this macromoth fauna includes species that existed in pre-clearance habitats which have adapted to and in some cases benefitted both from the clearances, for example by an increase in woodland edges, from the establishment of orchards and amenity trees and from the historical continuity of land and resource management so clearly evidenced at Mill Bank. This extended history of well-considered, self-sustaining human influence had brought positive benefits to many species of conservation interest (Tables 1, 2) but perhaps more importantly has had a stabilising influence on much of the entomofauna.

The response of moths to light traps set in dissected landscapes as opposed to elsewhere may warrant further consideration but sufficient evidence has now been assembled to infer that the moths of Mill Bank do form a reasonably cohesive diverse comparatively stable local fauna. Common threads link this moth fauna with the wider fauna of VC35, neighbouring Glamorgan and the region. Table 5 demonstrates this relationship across 141 species of Lepidoptera that are generally regarded as being either localised, scarce or rare in the UK followed by a commentary on 15 selected species and mention of a few more recent records.

TABLE 5. ANNOTATED LIST OF 141 SPECIES OF LOCAL, SCARCE OR RARE LEPIDOPTERA IN RELATION TO THE OVERVIEWS OF HORTON (1994) AND GILMORE ET AL. (2014). ARRANGEMENT FOLLOWS AGASSIZ ET AL. (2013). STATUS ASSESSMENTS HAVE BEEN INFORMED BY NBN ATLAS DATA ACCESSED MOST RECENTLY IN DECEMBER 2022 AND BY MORE COMPREHENSIVE DATA AT <http://www.gwentleps.org.uk>. SPECIES LISTED IN SHADED CELLS ARE DISCUSSED SEPARATELY.

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore et al., 2014)
Eriocraniidae	<i>Paracrania chrysolepidella</i> (Zeller, 1851)	1	Local	<i>Corylus avellana</i>	2017-05-04	Leaf mine	No records	No records
Hepialidae	<i>Phymatopus hecta</i> (Linnaeus, 1758)	1	Local	MV light	2011-06-26		Local low density	Uncommon thinly scattered
Nepticulidae	<i>Stigmella obliquella</i> (Heinemann, 1862)	1	Local	<i>Salix x sepulcralis</i> 'Chrysocoma'	2016-11-14	c20 VC 43 Wales	No records	
Nepticulidae	<i>Stigmella continuella</i> (Stainton, 1856)	1	Local	<i>Betula pendula</i>	2017-09-15	c21 VC 25 Wales	Trelleck Bog 1973 on <i>Betula</i>	Local widely scattered
Nepticulidae	<i>Antispila metallella</i> (Denis & Schiffermüller, 1775)	3	Local	<i>Cornus sanguinea</i>	2018-08-02	Leaf mine	No records	One record 1995
Heliozelidae	<i>Antispila petryi</i> (Martini, 1899)	1	Local	<i>Cornus sanguinea</i>	2018-07-31	Leaf mine	Slade Woods 1980; Wyndcliff 1990	No records
Adelidae	<i>Adela croesella</i> (Scopoli, 1763)	1	Local	In flight by brook	2018-05-24		Widespread	Six records coastal. 1979-2005
Adelidae	<i>Cauchas fibulella</i> (Denis & Schiffermüller, 1775)	1	Local	Hay meadow	2017-05-19		No records	Seven records 1918-2009, scarce
Adelidae	<i>Cauchas rufumitrella</i> (Scopoli, 1763)	1	Local	Hay meadow	2015-05-16		First VC Magor Marsh 1982	Eight records 1921-2004
Tineidae	<i>Infurcitinea argentimaculella</i> (Stainton, 1849)	1	Local	Lichen on wall	2018-04-05		No records	1989-2008 overlooked, on lichens
Tineidae	<i>Triaxomera fulvimitrella</i> (Sodoffsky, 1830)	1	Local	swept	2020-06-02		New VC Hael Woods 1982	No records
Tineidae	<i>Psychoides filicivora</i> (Meyrick, 1937)	1	Local	By house	2017-02-17		No records	Widespread on ferns
Gracillariidae	<i>Caloptilia cuculipennella</i> (Hübner, 1796)	2	Local	In house	2014-01-02	New VC. 4 Wales	No records	Four records 1920-2005 in west
Gracillariidae	<i>Caloptilia populetorum</i> (Zeller, 1839)	1	Local	MV light	2018-07-07		No records	One record 1907
Gracillariidae	<i>Caloptilia semifascia</i> (Haworth, 1828)	1	Local	<i>Acer campestre</i> L.	2018-06-22	Leaf mine	Present	Four records, one modern in 2003
Yponomeutidae	<i>Zelleria hepariella</i> Stainton, 1849	1	Local	In house	2017-10-11		Usk at light 1979	Six records 2005-2009
Lypusidae	<i>Agnoea flavifrontella</i> (Denis & Schiffermüller, 1775)	3	NS	MV light	2015-05-21	4 Wales, 50 UK in south	Llansoy at light 1986	No records
Depressariidae	<i>Agonopterix yeatiana</i> (Fabricius, 1781)	1	Local	MV light	2018-04-19		No records	15 records 1864-2009
Depressariidae	<i>Telechrysis tripuncta</i> (Howarth, 1828)	Unknown	NS	In greenhouse	2018-05-28		Llansoy at light 1992	Two records 1938
Gelechiidae	<i>Aproaerema larseniella</i> Gozmány, 1957	Unknown	Local	MV light	2012-06-28	10 Wales	Tintern 1970; Hael Woods	One record 1939
Gelechiidae	<i>Aproaerema taeniolella</i> (Zeller, 1839)	Unknown	Local	MV light	2021-07-01	19 VC. 23 Wales	No records	12 records 1924-2005

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore <i>et al.</i> , 2014)
Gelechiidae	<i>Monochroa cytisella</i> (Curtis, 1837)	Unknown	Local	MV light	2016-07-14		Trelleck Bog m.v. light 1986	17 records increasing
Gelechiidae	<i>Caryocolum junctella</i> (Douglas, 1851)	Unknown	NR	In house	2015-12-01	New VC 4 Wales, 8 UK	No records	One record Kenfig 1920
Momphidae	<i>Mompha langiella</i> (Hübner, 1796)	Unknown	Local	<i>Epilobium hirsutum</i>	2017-06-28		Hael Woods 1976 larvae	One record 2005
Pterophoridae	<i>Amblyptilia punctidactyla</i> (Haworth, 1811)	Unknown	Local	MV light	2013-06-29		Plas Newydd Usk 1972 1981	Widespread uncommon
Choreutidae	<i>Choreutis pariana</i> (Clerk, 1759)	Unknown	Local	MV light	2014-07-01		No records	Four records 1932-2002 rare
Tortricidae	<i>Olindia schumacharana</i> (Fabricius, 1787)	Unknown	Local	MV light	2014-07-01		Scarce and local woodland edges	Seven records 1924-2007 ?overlooked
Tortricidae	<i>Acleris schalleriana</i> (Linnaeus, 1761)	Unknown	Local	MV light	2012-08-24		First VC Wyndcliff 1990 <i>Viburnum lantana</i>	14 records 1917-2009 very scarce
Tortricidae	<i>Acleris kochiella</i> (Goeze, 1783)	Unknown	Local	MV light	2017-04-05		No records	Two records 1997-2002
Tortricidae	<i>Cochylis hybridella</i> (Hübner, 1813)	Unknown	Local	MV light	2012-08-24		First VC Usk 1980, Slade Woods 1986	Seven records 1970-2005 coastal
Tortricidae	<i>Apotomis capreana</i> (Hübner, 1817)	Unknown	Local	MV light	2016-08-19		Scarce local, wet woods valleys	Seven records 1979-2009 Very scarce
Tortricidae	<i>Endothenia nigricostana</i> (Haworth, 1811)	Unknown	Local	In greenhouse	2018-06-07		Distribution unknown	Three records 1917-1996 Very scarce
Tortricidae	<i>Spilonota laricana</i> (Heinemann, 1863)	Unknown	Local	MV light	2014-07-03	11 Wales	Widespread common larch plantations	Three records 1926-1950
Tortricidae	<i>Cydia illutana</i> (Herrich-Schaeffer, 1851)	Unknown	Very local	MV light	2018-06-20	See text	No records	No records
Tortricidae	<i>Cydia deshaisiana</i> (Lucas, 1858)	Unknown	NR	MV light	2019-08-25		No records	No records
Tortricidae	<i>Grapholita lunulana</i> (Denis & Schiffermüller, 1775)	Unknown	NS	MV light	2012-06-28	6 VC 54 Wales, mostly northern	No records	One record 2005
Tortricidae	<i>Grapholita tenebrosana</i> (Duponchel, 1843)	Unknown	Local	Greenhouse	2021-05-19		No records	16 records 2001-2006
Tortricidae	<i>Pammene trauniana</i> (Denis & Schiffermüller, 1775)	1	NR	<i>Acer campestre</i> L.	2020-06-20	See text	No records	No records
Tortricidae	<i>Strophedra weirana</i> (Douglas, 1850)	Unknown	Local	MV light	2017-05-26	c24 VC, 136 UK	Scarce and local	No records
Sesiidae	<i>Synanthedon myopaeformis</i> (Borkhausen, 1789)	Unknown	NS	<i>Malus domestica</i>	2013-07-23	33 VC, 8 sites BAP	No records	No records
Hesperiidae	<i>Erynnis tages</i> Linnaeus, 1758	Unknown	Local	Hay meadow	2004-05-31	>500 VC widespread	Uncommon declining eastern	
Pieridae	<i>Leptidea sinapis</i> (Linnaeus, 1758)	3	Local	Woodland edge	2004-06-12	See text	Very local and scarce	
Lycaenidae	<i>Thecla betulae</i> (Linnaeus, 1758)	1	NR	<i>Malus domestica</i>	1998-07-25	See text	Very rare one old record	

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore <i>et al.</i> , 2014)
Lycaenidae	<i>Satyrium w-album</i> (Knoch, 1782)	2	NS	In flight	2002-08-02	2002 only. NERC Act, BAP(UK) schedule 5 (1981 Act)	Local in the east	
Pyralidae	<i>Cryptoblabes bistriga</i> (Haworth, 1811)	Unknown	Local	MV light	2017-06-20		Scarce 1986, 1987	26 records 1857-2009
Pyralidae	<i>Salebriopsis albicilla</i> (Herrich-Schäffer, 1849)	1	NR	MV light	2015-06-14	54 VC	First VC 1964 Wyndcliff Lower Wye Valley only	No records
Pyralidae	<i>Dioryctria simplicella</i> (Heinemann, 1863)	1	Local	MV light	2015-06-30		No records	Two records 2000-2005
Pyralidae	<i>Assara terebrella</i> (Zincken, 1818)	Unknown	Very local	MV light	2012-08-10		No records	No records
Pyralidae	<i>Ephestia elutella</i> (Hübner, 1796)	Unknown	NS	MV light	2019-06-02	New VC 83 Wales conurbations	No records	67 records conurbations increasing
Crambidae	<i>Anania fuscalis</i> (Denis & Schiffermüller, 1775)	Unknown	Local	MV light	2017-05-26		Local uncommon	75 records
Crambidae	<i>Evergestis pallidata</i> (Hufnagel, 1767)	Unknown	Local	MV light	2012-07-27		Fairly common damp woods, marshes	Locally common
Crambidae	<i>Calamotropha paludella</i> (Hübner, 1824)	Unknown	Scarce	MV light	2018-07-28		No records	18 records 1995-2009 increasing
Crambidae	<i>Agriphila latistria</i> (Howarth, 1811)	Unknown	Local	MV light	2019-08-25		Usk 1971-1977 very scarce	Widespread
Crambidae	<i>Agriphila selasella</i> (Hübner, 1813)	Unknown	Local	MV light	2012-08-02		Abertillery 1911 only	Much scarcer in the east
Drepanidae	<i>Watsonalla cultraria</i> (Fabricius, 1775)	12	Local	MV light	2002-08-02		Scarce local Wye Valley beech woods	Scarce beech woods only
Drepanidae	<i>Tethea or</i> (Denis & Schiffermüller, 1775)	2	Local	MV light	2010-06-05	44 VC 12 elsewhere Wales	First VC Usk Castle 1966 very scarce	Three records 1857-1994 Very rare
Drepanidae	<i>Tetheella fluctuosa</i> (Hübner, 1803)	83	Local	MV light	2002-06-04	Widespread 462 Wales, 2175 UK	Locally abundant Wye Valley area and east	Scarce restricted to birch-alder woodland
Drepanidae	<i>Ochropacha duplaris</i> (Linnaeus, 1761)	22	Local	MV light	2020-07-25		Widespread uncommon	Widespread birch woodland
Drepanidae	<i>Polyploca ridens</i> (Fabricius, 1787)	41	Local	MV light	2020-04-11		Widespread common in east	32 records 1977-2009 scarce oak woods
Sphingidae	<i>Deilephila porcellus</i> (Linnaeus, 1758)	3	Local	MV light	2015-06-30		Widespread scarce in west	Widespread dunes heaths
Geometridae	<i>Idaea trigeminata</i> (Haworth, 1809)	23	Local	MV light	2011-08-02		Scarce local eastern oak woods	21 records 1886-2009 scarce
Geometridae	<i>Idaea straminata</i> (Borkhausen, 1794)	1	Local	MV light	2001-08-04		Scarce local eastern oak woods northern moors	Uncommon sporadic widespread
Geometridae	<i>Scopula floslactata</i> (Haworth, 1809)	19	Local	MV light	2001-05-24		Common widespread	Common, widespread

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore <i>et al.</i> , 2014)
Geometridae	<i>Cyclophora punctaria</i> (Linnaeus, 1758)	43	Local	MV light	2001-05-27		Local eastern oakwoods	Scarce restricted to oakwoods, Gower
Geometridae	<i>Cyclophora linearia</i> (Hübner, 1799)	19	Local	MV light	2014-07-24		Widespread common beechwoods	Scarce, localised, widespread
Geometridae	<i>Scotopteryx mucronata</i> (Scopoli, 1763)	2	Local	MV light	2001-07-20		Widespread common in east	Uncommon, heaths, moorlands
Geometridae	<i>Epirrhoe rivata</i> (Hübner, 1813)	3	Local	MV light	2019-06-29		Rare, 1980 Slade Woods	Uncommon, widespread in south
Geometridae	<i>Euphyia biangulata</i> (Haworth, 1809)	4	Local	MV light	2002-07-16		Very local Wye Valley woods	Five records 1886-2005 very rare
Geometridae	<i>Euphyia unangulata</i> (Haworth, 1809)	38	Local	MV light	2002-07-16		No records	Scarce, restricted, south only
Geometridae	<i>Chloroclysta miata</i> (Linnaeus, 1758)	1	Local	MV light	2019-09-29		Rare four records	29 recs 1880-2008 scarce restricted
Geometridae	<i>Lampropteryx otregiata</i> (Metcalf, 1917)	1	NS	MV light	2000-03-21	See text	First VC 1973 one site only	Widespread valley woods
Geometridae	<i>Euchoeca nebulata</i> (Scopoli, 1763)	9	Local	MV light	2012-07-27		Local damp woods valleys	Uncommon widespread alder woods
Geometridae	<i>Rheumaptera undulata</i> (Linnaeus, 1758)	2	Local	MV light	2018-07-02		Scarce and local eastern woods	Very local widespread
Geometridae	<i>Perizoma albulata</i> (Denis & Schiffmüller, 1775)	49	Local	MV light	2012-05-17	NERC Act	Common widespread	Restricted coastal dunes
Geometridae	<i>Martania taeniata</i> (Stephens, 1831)	1	NS	MV light	2010-05-15	New VC 27 Wales, 462 UK, scattered	Rare, near Tintern 1879, 1972	No records
Geometridae	<i>Eupithecia haworthiata</i> Doubleday, 1856	11	Local	MV light	2014-07-10		Widespread common central and south-east	Uncommon restricted Gower Cardiff
Geometridae	<i>Eupithecia tripunctaria</i> Herrich-Schäffer, 1852	7	Local	MV light	2011-08-02		Common widespread	Common widespread
Geometridae	<i>Eupithecia simpliciatata</i> (Haworth, 1809)	1	Local	MV light	2000-08-11		First and only VC 2.8.1991	11 records 1885-2006 scarce local
Geometridae	<i>Eupithecia trisignaria</i> Herrich-Schäffer, 1849	15	Local	MV light	2020-05-17		Local damp woodland	Scarce, restricted, damp woodland
Geometridae	<i>Eupithecia millefoliata</i> Rössler, 1866	1	NS	MV light	2002-07-05	See text	No records	No records
Geometridae	<i>Lobophora halterata</i> (Hufnagel, 1767)	3	Local	MV light	2014-05-08		Scarce damp eastern woodlands	Scarce restricted sporadic
Geometridae	<i>Acasis viretata</i> (Hübner, 1799)	25	Local	MV light	2020-08-27		Common widespread	Common, widespread
Geometridae	<i>Trichopteryx polycommata</i> (Denis & Schiffmüller, 1775)	1	NS	MV light	2002-04-03	New to Wales; 38 one site 2016-2019, south-eastern BAP(UK)	No records	No records

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore <i>et al.</i> , 2014)
Geometridae	<i>Archiearis parthenias</i> (Linnaeus, 1761)	1	Local	MV light	2002-03-26		Scarce local	Scarce restricted birch woods
Geometridae	<i>Abraxas sylvata</i> (Scopoli, 1763)	63	Local	MV light	2002-08-02	Decline since 2000	Local in east	Uncommon widespread
Geometridae	<i>Ligdia adustata</i> (Denis & Schiffermüller, 1775)	9	Local	MV light	2010-06-23	Larva <i>Euonymus europaeus</i> 21.9.21	Widespread scarce in east	Common widespread
Geometridae	<i>Macaria notata</i> (Linnaeus, 1758)	2	Local	MV light	2017-08-23		Scarce local	Uncommon widespread
Geometridae	<i>Plagodis dolabraria</i> (Linnaeus, 1767)	91	Local	MV light	2001-06-20		Widespread common in east	Common widespread
Geometridae	<i>Pachycnemia hippocastanaria</i> (Hübner, 1799)	1	NS	MV light	2002-07-05	New VC (also one 2016) 11 Wales, s. focus n to Scotland	No records	Very rare two records
Geometridae	<i>Apeira syringaria</i> (Linnaeus, 1758)	2	Local	MV light	2015-06-23		Local	Uncommon widespread
Geometridae	<i>Ennomos quercinaria</i> (Hufnagel, 1767)	17	Local	MV light	2020-07-25	Decline since 2000 BAPRe NERC Act	Scarce sporadic woodland	Common widespread
Geometridae	<i>Selenia lunularia</i> (Hübner, 1788)	5	Local	MV light	2020-05-28		Scarce local deciduous woods	Very scarce and restricted woodland
Geometridae	<i>Apocheima hispidaria</i> (Denis & Schiffermüller, 1775)	1	Local	MV light	2012-03-10		Scarce local eastern oak woods	Scarce restricted 13 recs 1912-1995
Geometridae	<i>Hypomecis roboraria</i> (Denis & Schiffermüller, 1775)	7	Local	MV light	2017-06-20	24 VC five Wales elsewhere, s--east UK increasing	Scarce five records Wye Valley Dean oak woods	Very rare oak woods two old records
Geometridae	<i>Paradarisa consonaria</i> (Hübner, 1799)	38	Local	MV light	2002-06-09		Locally common	Uncommon widespread
Geometridae	<i>Parectropis similaria</i> (Hufnagel, 1767)	10	Local	MV light	2010-05-28		Very local, a few eastern deciduous woods	Very rare two records
Geometridae	<i>Cleorodes lichenaria</i> (Hufnagel, 1767)	2	Local	MV light	2020-09-15		Common widespread	Common limestone only
Geometridae	<i>Hemistola chrysoprasaria</i> (Esper, 1794)	1	Local	MV light	2001-06-20	Population collapse 1998, 239 Wales BAPRe NERC Act	Local in east and south	Common widespread
Notodontidae	<i>Furcula bicuspis</i> (Borkhausen, 1790)	27	Local	MV light	2011-05-06		Fairly common damp woods valleys	Scarce damp woods Betulaceae
Notodontidae	<i>Furcula bifida</i> (Brahm, 1787)	11	Local	MV light	2020-08-08		Rare	Scarce and sporadic 25 records
Notodontidae	<i>Drymonia dodonaea</i> (Denis & Schiffermüller, 1775)	26	Local	MV light	2001-05-24		Very local eastern oak woods	Very local
Notodontidae	<i>Peridea anceps</i> (Goeze, 1781)	19	Local	MV light	2001-04-28		Eastern oak woods	Very rare four records 1890-1956
Notodontidae	<i>Clostera curtula</i> (Linnaeus, 1758)	6	Local	MV light	2001-05-24		Local uncommon first VC Usk Castle 1961	Scarce increasing 22 records 1996-2009

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore <i>et al.</i> , 2014)
Erebidae	<i>Hypena crassalis</i> (Fabricius, 1787)	1	Local	MV light	2002-07-28		Eastern woodlands with Bilberry	Widespread in uplands
Erebidae	<i>Callimorpha dominula</i> (Linnaeus, 1758)	4	Local	MV light	2006-07-01	In flight two at MV light	Rare seven records	Scarce restricted 33 records
Erebidae	<i>Nudaria mundana</i> (Linnaeus, 1761)	33	Local	MV light	2000-08-11		Infrequent walls quarries	Common widespread
Erebidae	<i>Lithosia quadra</i> (Linnaeus, 1758)	10	Local	MV light	2018-07-07	77 VC 81 elsewhere Wales mostly coastal	No records	Uncommon resident on Gower
Erebidae	<i>Atolmis rubricollis</i> (Linnaeus, 1758)	18	Local	In flight	2008-05-30	In flight	Widespread local	Uncommon widespread
Erebidae	<i>Eilema complana</i> (Linnaeus, 1758)	32	Local	MV light	2014-06-25		Common widespread	Common widespread
Erebidae	<i>Paracolax tristalis</i> (Fabricius, 1794)	1	NS	MV light	2010-06-23	See text	No records	No records
Erebidae	<i>Schrankia costaestrigalis</i> (Stephens, 1834)	8	Local	MV light	2014-06-19		Scarce damp woods fens bogs valleys	Common widespread
Erebidae	<i>Laspeyria flexula</i> (Denis & Schiffermüller, 1775)	75	Local	MV light	2001-06-28		Local	Uncommon woodland species
Erebidae	<i>Catocala fraxini</i> (Linnaeus, 1758)	4	NS	MV light	2020-09-09	See text	No records	No records
Noctuidae	<i>Acronicta alni</i> (Linnaeus, 1767)	13	Local	MV light	2010-06-05		Widespread local eastern woods and valleys	Common widespread
Noctuidae	<i>Acronicta aceris</i> (Linnaeus, 1758)	2	Local	MV light	2014-06-25		Rare two records, first VC 1985	Very rare two records 2007, 2008
Noctuidae	<i>Craniophora ligustri</i> (Denis & Schiffermüller, 1775)	346	Local	MV light	2002-07-16		Scarce local eastern ash woods	Common widespread
Noctuidae	<i>Panemeria tenebrata</i> (Scopoli, 1763)	3	Local	Hay meadow	2014-05-14	In flight hay meadow	Local uncommon	Scarce restricted 41 records
Noctuidae	<i>Stilbia anomala</i> (Haworth, 1812)	2	Local	MV light	2014-08-31		Damp woods boggy heaths in west	Uncommon, heaths, moorland
Noctuidae	<i>Nyctobrya muralis</i> (Forster, 1771)	3	Local	MV light	2016-07-20		Rare three sites only	Widespread coastal
Noctuidae	<i>Dypterygia scabriuscula</i> (Linnaeus, 1758)	1	Local	MV light	2002-08-02		No records	No records
Noctuidae	<i>Mormo maura</i> (Linnaeus, 1758)	3	Local	MV light	2002-08-02		Sporadic infrequent	Uncommon widespread valleys
Noctuidae	<i>Helotropha leucostigma</i> (Hübner, 1808)	2	Local	MV light	2011-08-02	310 Wales (BAP)	Scarce first VC Usk.1974	Scarce restricted lowland fens
Noctuidae	<i>Oligia versicolor</i> (Borkhausen, 1792)	14	Local	MV light	2012-06-28		Common widespread	Common widespread
Noctuidae	<i>Cirrhia gilvago</i> (Denis & Schiffermüller, 1775)	1	Local	MV light	2013-10-06	12 VC.	Rare five records, first VC Usk Castle.1966	Common widespread

Family	Species	No of records	UK status	Mill Bank Provenance	Mill Bank first record	Comment	Monmouthshire (Horton, 1994)	Glamorganshire (Gilmore <i>et al.</i> , 2014)
Noctuidae	<i>Conistra rubiginea</i> (Denis & Schiffmüller, 1775)	1	Local	MV light	2002-04-20	40 VC range edge increase since 2000	Two records 1869, 1876	Very rare five records 1857-2003
Noctuidae	<i>Lithophane semibrunnea</i> (Haworth, 1809)	1	Local	MV light	2011-04-09		Rare five records	Scarce restricted 23 records
Noctuidae	<i>Lithophane socia</i> (Hufnagel, 1766)	3	Local	MV light	2002-04-20		Not uncommon	No records
Noctuidae	<i>Ipimorpha subtusa</i> (Denis & Schiffmüller, 1775)	1	Local	MV light	2020-08-08		Scarce and local larvae on <i>Populus</i>	Uncommon restricted, on <i>Populus</i>
Noctuidae	<i>Cosmia pyralina</i> (Denis & Schiffmüller, 1775)	2	Local	MV light	2017-07-15		Scarce local first VC 1969	Scarce restricted 12 records
Noctuidae	<i>Apterogenum ypsilon</i> (Denis & Schiffmüller, 1775)	1	Local	MV light	2011-07-05		Scarce local marshes valleys	Uncommon restricted Salicaceae
Noctuidae	<i>Polymixis flavicincta</i> (Denis & Schiffmüller, 1775)	1	Local	MV light	2017-10-04		Very scarce seven records	Common coastal
Noctuidae	<i>Lacanobia contigua</i> (Denis & Schiffmüller, 1775)	1	Local	MV light	2019-06-02		Scarce in east common western hills	Uncommon heath moorland
Noctuidae	<i>Mythimna turca</i> (Linnaeus, 1761)	1	NS	MV light	2015-07-15	c176 VC 1606 Wales west focus	First VC Usk Castle 1969	Common widespread
Noctuidae	<i>Mythimna l-album</i> (Linnaeus, 1767)	1	NS	MV light	2018-10-03	See text	No records	Rare coastal seven records 2004-09
Noctuidae	<i>Cerastis leucographa</i> (Denis & Schiffmüller, 1775)	7	Local	MV light	2012-03-10		Local woodland species	Very rare four records 1857-1992
Noctuidae	<i>Xestia stigmatica</i> Hübner, 1813	1	NS	MV light	2011-04-09	3 VC 77 Wales	No records	No records
Nolidae	<i>Meganola albula</i> (Denis & Schiffmüller, 1775)	1	NS	MV light	2018-07-12	7 VC range east/s-east	No records	No records
Nolidae	<i>Nola confusalis</i> (Herrich-Schäffer, 1847)	23	Local	MV light	2013-05-30		Widespread common eastern woodlands	Common widespread
Nolidae	<i>Bena bicolorana</i> (Fuessly, 1775)	2	Local	MV light	2020-06-16		Sporadic eastern oakwoods	Uncommon widespread
Nolidae	<i>Nycteola revayana</i> (Scopoli, 1772)	7	Local	MV light	2019-05-17		Common widespread	Uncommon widespread
Nolidae	<i>Earias clorana</i> (Linnaeus, 1761)	6	Local	MV light	2018-05-28	9 VC (range edge) 2015-20 e/s-e focus	First VC new to Wales, Usk, 1993	No records

SELECTED SPECIES OF LEPIDOPTERA

***Agnoea flavifrontella*. NS Nationally Scarce.** At MV light on 21 May 2015, elsewhere at light, Llansoy, 1986 (Horton, 1994). Four Welsh records, mostly a southern species in UK. Larvae encased in leaf litter.

***Caryocolum junctella*. NR Nationally Rare.** One hibernant in house on 1 December 2015. New to VC, four Welsh records including one at Kenfig in 1920 (Gilmore *et al.*, 2014). Scattered mostly in western coastal counties *viz.* Anglesey, Caernarvonshire, Flintshire, Glamorganshire, South Lancashire and South Essex (NBN Atlas data accessed 8.2.2023). Host plants in Caryophyllaceae *viz.* *Cerastium* spp. and *Stellaria graminea* Linnaeus. Local breeding remains possible as these plant genera are well represented.

***Cydia illutana*. Very local.** One at MV light on 20 June 2018, no other Welsh records. Larvae feed on seeds inside cones of larch (*Larix* spp. and hybrids) and fir (*Abies* spp.). First UK record was in 1975 (Sterling & Parsons, 2012).

***Pammene trauniana*. NR Nationally Rare.** One on Field Maple *Acer campestre* L. on 20 June 2020. New to Wales, nine UK records 1990-2020 (NBN atlas data accessed 13 December 2022) especially North Somerset. Larvae consume seeds of Field Maple. Mostly south-eastern, rare (Sterling & Parsons, 2012).

***Leptidea sinapis*. BAP (W); NERC Act 2006, Sections 41/42:** Species of Principal Importance in England and Wales. Highly localised; around woodland edges on 13, 14 and 15 June 2004 only. Four VC records 1926-1982, 16 Welsh records (NBN atlas accessed 31 January 2023). According to Fowles (1994) *L. sinapis* was local in south and east Wales with the scale of decline in both distribution and population quantified by Botham, Brereton, Middlebrook, Randle & Roy (2013). At the northern edge of its European range in Britain *L. sinapis* was regarded as threatened by the early 1990s (Jeffcoate, 2006). The conservation of thermophilous species at the northern edge of their range is especially complex and available habitat patches are typically smaller, more isolated and potentially ephemeral (Bourn & Thomas, 2002).

***Thecla betulae*. NR Nationally Rare. NERC Act 2006, Sections 41/42:** Species of Principal Importance in England and Wales. Limited protection under Schedule 5 of the Wildlife & Countryside Act. One basking on apple tree foliage 25 July 1998. Horton (1994) regarded *T. betulae* as very rare with one old VC record. Fowles (1994) regarded *T. betulae* as local in south and east Wales. In North Wales Whalley (1998) recorded the last Gwynedd example in 1979. The extent of wider decline was clarified by Asher *et al.* (2001). Host plants in Rosaceae *viz.* *Prunus spinosa* L. and *Prunus domestica* L.

***Salebriopsis albicilla*. NR Nationally Rare.** One at MV light 14 June 2015, first VC record 1964. No Glamorganshire records cited by Gilmore *et al.* (2014). A lime *Tilia* specialist of the Lower Wye Valley gorge woods (Horton, 1994) and Worcestershire lime woods (Simpson, 2022a; Whitehead, 2022c).

***Lampropteryx otregiata*. NS Nationally Scarce.** One at MV light, 21 March 2000, 47 VC records [<http://www.gwentleps.org.uk/moths/1797>], first VC record 1973, increasing since 1998. In Glamorganshire widespread in valley woods. Strictly western, range recently extending (Higgot, 2009; Simpson, 2022b) especially northwards (Lee, 2016; Waring & Townsend, 2017). Host plants in Rubiaceae e.g. hygrophilous *Galium* spp.

***Eupithecia millefoliata*. NS Nationally Scarce.** One at MV light 5 July 2002, new to Wales [<http://www.gwentleps.org.uk/moths/1881>]; largely eastern and south-eastern in UK extending from south coast north to Thames estuary. First UK record in Kent 1933, now gradually spreading north-westwards (Waring & Townsend, 2017).

***Paracolax tristalis*. NS Nationally Scarce. NERC Act 2006, Sections 41/42:** Species of Principal Importance in England and Wales. One at MV light on 23 June 2010 new to VC. One other Welsh record from Anglesey; UK distribution is strongly south-eastern noting records from Leigh Woods near Bristol in 1973 and 1974. A woodland species with larvae in spun fallen oak leaves hibernating *in situ* (Bretherton, Goater & Lorimer, 1983).

***Catocala fraxini*. NR Nationally Scarce.** First record at MV light on 9 September 2020 with others on 15 and 20 September and 6 October. One on 1 September 2021; details given by Anthony (2021)

are incorrect. The first VC record was on 25 September 2018 at Undy followed by three at Tintern on 24 and 25 September and 12 October 2019 (Lynn & Lynn, 2020). In 2020 the VC count of *C. fraxini* reached 30 individuals between 14 August and 27 October at Newport (10), Tintern (9), Penallt (Mill Bank, 4), Great Crwys, Hendre (2), Dingestow (2) and singly at Llandogo, Usk and Risca (Anthoney, 2020).

In 2021 a total of 23 *C. fraxini* was recorded from nine VC sites between 1 September and 17 October including eight at Tintern (Anthoney, 2021); synchronicity occurs between some Mill Bank and Tintern records. The historical status of this species in Britain was summarised by Bretherton, Goater & Lorimer (1983) and Clancy (2019) highlighted historical changes in the British distribution including the consolidation of populations in southern coastal counties during this century. The first record for Cornwall (VC2) was from Heligan on 20 October 2010 (Briggs, 2011) with more recent records from Buckinghamshire (Wilton, 2020). The interesting observation by Bell (2007) that larvae raised in Hampshire readily consumed the foliage of poplar *Populus* spp. or hybrids, but not Aspen *Populus tremula* may have relevance here.

***Mythimna l-album*. (Fig. 10:5) NS Nationally Scarce.** New to VC at MV light on 3 October 2018 with another on 10 September 2021, hitherto rare in Wales. In Glamorganshire Gilmore *et al.* (2014) cite seven coastal records between 2004 and 2009. According to Bretherton, Goater & Lorimer (1979) *M. l-album* is rarely found more than a mile inland from the English south coast and the recent spread to South Wales was confirmed by Waring & Townsend (2017). Recent records from Tintern during October 2020 and 2021 suggest upstream movement in the Wye valley. Larvae overwinter and consume grasses especially in brackish ditches. Mr S. Bosanquet's moth trapping programme at Dingestow Court, 7.7 kms west of Mill Bank, recorded no examples of this species up to the end of 2020.

***Cerastis leucographa*. Local.** Seven individuals at MV light viz., 10 March 2012, 15 April 2015, 4 March 2018, 21 March 2019, 6 April 2019 and 11 April 2020. **A localised woodland species** in Monmouthshire (Horton, 1994) with fifteen VC records from 1967 to 2000 (NBN atlas accessed 7 January 2023); very rare in Glamorganshire (Gilmore *et al.*, 2014) with four records from 1857-1992. A vernal species of woodland, hedges and scrub that overwinters as a pupa. Bretherton, Goater & Lorimer (1979) discussed the fastidiousness and distributional discontinuities of this species.

***Xestia stigmatica*. NS Nationally Scarce.** One at MV light on 9 April 2011 new to the VC; absent from Glamorganshire (Gilmore *et al.*, 2014). According to NBN atlas (accessed 7 January 2023) there are 77 Welsh records with the last on 4 August 1999. A possible marked consistent decline since 2010 and evidently declining in the ancient Chiltern beech woods. According to Bretherton, Goater & Lorimer (1979) *X. stigmatica* is: "Local and elusive in open deciduous woodland on chalk and gravel." According to Waring & Townsend (2017) it is: "Dominantly south-eastern in England with discrete populations in Wales and the English Midlands." According to Brown (2018) this species favours open broadleaved woodland and scrub. Parsons (2004) urged caution regarding claimed Welsh records of this species.

***Meganola albula*. NS Nationally Scarce.** One at MV light on 12 July 2018; according to <http://www.gwentleps.org.uk/> (accessed 13 December 2022) there are seven VC records. Not cited by Horton (1994) or Gilmore *et al.* (2014). In the UK strongly limited to southern and south-eastern coastal counties (Waring & Townsend, 2017) expanded north-westwards since the 1980s (Simpson, 2022b). Host plant genera include *Rubus*, *Fragaria* and *Vaccinium*.

Additional species of macromoths recorded at Mill Bank between 1 January 2021 and 4 August 2022 are one sphingid, nine noctuids, and two geometrids. *Sphinx ligustri* Linnaeus, 1758 on 1 July 2021 is scarce in Monmouthshire and may have declined since 2000. *Lacanobia suasa* (Denis & Schiffermüller, 1775) on 21 September 2021 and *Hecatera bicolorata* (Hufnagel, 1766) on 27 June 2021 have coastal affinities. *Mythimna unipuncta* (Haworth, 1809) on 28 July 2022 and *Mythimna albipuncta* (Denis & Schiffermüller, 1775) on 30 July 2022 are localised or scarce migrants in Wales their larvae feeding on grasses, the latter species becoming expansive (Simpson, 2022b)



Fig. 10. Insect diversity at Mill Bank. 1. The oecophorid moth *Alabonia geoffrella* (Linnaeus, 1767), 19 May 2022, believed to breed in the decaying wood of Hazel *Corylus avellana* L.; 2. Newly emerged V-pug *Chloroclystis v-ata* (Haworth, 1809), The Dingle, 13 April 2022; 3. Larva of the lichenophagous eravid moth *Miltochrista miniata* (Forster, 1771), 24 June 2015; 4. Larva of the lichenophagous eravid moth *Laspeyria flexula* in the high crown of a veteran pear tree, 20 April 2017; 5. The noctuid moth *Mythimna l-album*, in cop., 9 October 2021; 6. First instar larva of the geometrid moth *Colotois pennaria* (Linnaeus, 1761) from cultivated broom *Cytisus scoparius* (L.) Link., 19 May 2022, a recognised host plant at Mill Bank.

COLEOPTERA: BEETLES

The 6984 beetles examined between 2011 and 2022 are represented by 469 species in 56 families. Five species representing six families are Nationally Rare (NR), 31 species representing 17 families are Nationally Scarce (NS). Three NR species and all of the NS species have breeding populations. Coleoptera have a high level of niche occupancy and many species are highly discriminating rendering them useful indicators of habitat, habitat quality, biodiversity and ecology (Fig. 11) often on small spatial scales. If the entire land area of Mill Bank were to be divided into 100m² grids there would be about 200. In a single year, 2012 for example, it proved theoretically possible to add one hitherto unrecognised species of beetle to each of the 200 grids during 24 hours of field work. Such data reflect positively on diversity, the carrying capacity of the site and doubtless also on the quality of its immediate surroundings.

In this account the focus is limited to species which are local, scarce or rare and which are frequently more fastidious or instructive. A key objective is determining how Mill Bank supports these species either directly or indirectly through management practice, itself an inherently difficult matter. Table 6 identifies 'culture-favoured' beetles, i.e. those that are linked to human activity and in some instances have been for millennia (Kenward & Carrott, 2006).

A classic example of the difficulty of defining synanthropy is that provided by the Noble Chafer *Gnorimus nobilis* (Linnaeus, 1758), an ancient woodland species that has adapted to traditional orchards (Whitehead, 2001, 2003a, 2006, 2007). On this basis almost all orchard macroinvertebrates could be regarded as culture-favoured and at Mill Bank the majority of beetles could be construed in the same way, their habits modified extensively by the presence of Balwen Mountain Sheep, log stores, fruit stores, green rooves, green hay, stored hay, herbage piles, cultivation, compost heaps and traditional buildings. This matter was touched on by New (2010) and is dominated by relatives not absolutes. Eversham *et al.* (1996) emphasised the wider significance of 'anthropogenic analogues' *sensu* Mill Bank; more extreme examples include that cited by Whitehead (1998). Tables 1 and 2 provide further analyses in this regard. Some synanthropic species have appeared in Britain very recently (Whitehead, 2022b) while others have been tied to humankind since prehistory (Elias, 1994). The key point is that management at Mill Bank has contributed positively to the biodiversity of beetles. Of the 93 species listed in Table 6 that are localised in the VC at least 33 benefit from traditional management practice; 25 of these are discussed individually. Management-orientated species occur on a variety of spatial scales. The staphylinid *Crataraea suturalis* (Mannerheim, 1830) breeds in the hay shed and nowhere else. In contrast larvae of the silphid *Silpha tristis* Illiger, 1798 use the entire site, but as with its congeners elsewhere, strongly favour hay meadows.

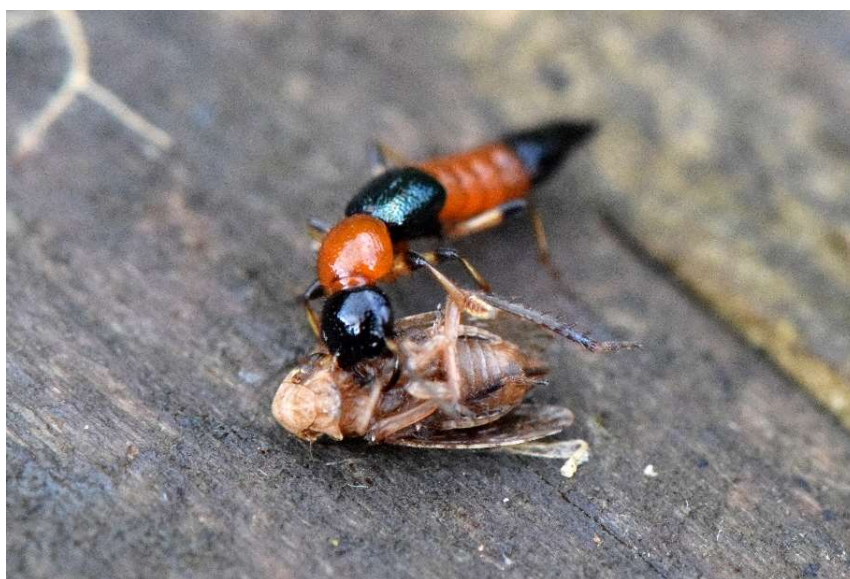


Fig. 11. The staphylinid beetle *Paederus littoralis* (Gravenhorst, 1802) preying the auchenorrhynchan *Anoscopus serratulae* (Fabricius, 1775) on 20 August 2019.

TABLE 6. SELECTIVE LIST OF 93 SPECIES OF COLEOPTERA WITH LESS THAN 10 VC RECORDS SHOWING TOTAL NUMBER OF SITE, VC, WELSH AND UK RECORDS BASED ON NBN ATLAS DATA (ACCESSED 30 OCTOBER 2022). THE 25 SPECIES LISTED IN SHADED CELLS ARE DISCUSSED INDIVIDUALLY.

Species * markedly culture-favoured	UK Status	Mill Bank	VC35	Wales	UK
<i>Gyrinus urinator</i> Illiger, 1807		1	7	28	520
<i>Carabus monilis</i> Fabricius, 1792	NS	1	4	31	688
<i>Perigona nigriceps</i> (Dejean, 1831)*	Naturalised	1	0	3	195
<i>Helophorus alternans</i> Gené, 1836	NS	1	3	39	427
<i>Carcinops pumilio</i> (Erichson, 1834)*		2	0	17	202
<i>Ptenidium fuscicorne</i> Erichson, 1845		3	1	40	155
<i>Margarinotus ventralis</i> (Marseul, 1854)*		1	3	85	369
<i>Ptinella aptera</i> (Guérin-Ménéville, 1839)		3	1	8	123
<i>Agathidium varians</i> Beck, 1817		1	0	44	239
<i>Phloeostiba plana</i> (Paykull, 1792)	NS	8	1	3	70
<i>Xylodromus concinnus</i> (Marsham, 1802)*		32	3	41	211
<i>Reichenbachia juncorum</i> (Leach, 1817)		3	5	138	359
<i>Sepedophilus bipunctatus</i> (Gravenhorst, 1802)	NS	6	2	9	89
<i>Sepedophilus littoreus</i> (Linnaeus, 1758)		7	7	5	230
<i>Sepedophilus testaceus</i> (Fabricius, 1792)		1	0	4	56
<i>Cilea silphoides</i> (Linnaeus, 1767)*		1	0	2	115
<i>Aleochara discipennis</i> Mulsant & Rey, 1853	NS	1	0	7	48
<i>Cratarea suturalis</i> (Mannerheim, 1830)*		>700	0	3	84
<i>Oxyteta annularis</i> (Mannerheim, 1830)		1	0	5	73
<i>Haploglossa villosula</i> (Stephens, 1832)		1	1	18	104
<i>Dexiogyia corticina</i> (Erichson, 1837)	NS	1	2	5	70
<i>Oligota apicata</i> Erichson, 1837	NS	1	1	10	129
<i>Oligota punctulata</i> Heer, 1839*		2	1	12	118
<i>Oligota parva</i> Kraatz, 1862*		38	1	2	56
<i>Gyrophaena angustata</i> (Stephens, 1832)	NS	1	1	21	121
<i>Placusa tachyporoides</i> (Waltl, 1838)	NS	2	1	5	48
<i>Liogluta longiuscula</i> (Gravenhorst, 1802)		1	0	19	162
<i>Mocyta negligens</i> (Mulsant & Rey, 1873)	NR	11	0	3	9
<i>Trichiusa immigrata</i> Lohse, 1984*		7	0	0	79
<i>Atheta excellens</i> (Kraatz, 1856)		1	0	4	35
<i>Acrotona muscorum</i> (Brisout de Barneville, 1860)		1	0	8	135
<i>Atheta palustris</i> (Kiesenwetter, 1844)		1	2	7	100
<i>Atheta harwoodi</i> Williams, 1930		1	3	23	136
<i>Aloconota sulcifrons</i> (Stephens, 1832)		2	0	48	156
<i>Scaphisoma boleti</i> (Panzer, 1793)		2	0	17	216
<i>Carpelimus erichsoni</i> (Sharp, 1871)		2	0	0	18
<i>Oxytelus sculptus</i> Gravenhorst, 1806*		12	1	16	175
<i>Scopaeus sulcicollis</i> (Stephens, 1833)*	NS	7	0	4	34
<i>Medon apicalis</i> (Kraatz, 1857)	NS	1	0	0	42
<i>Rugilus erichsonii</i> (Fauvel, 1867)*		14	3	91	494
<i>Rugilus rufipes</i> Germar, 1836		7	9	49	692
<i>Rugilus similis</i> (Erichson, 1840)	NR	2	0	2	49
<i>Othius angustus</i> Stephens, 1833		2	0	76	307
<i>Hypnogyra angularis</i> Ganglbauer, 1894	NS	1	4	6	70
<i>Quedius lucidulus</i> Erichson, 1839*	Naturalised	4	0	0	6
<i>Heterothops praeivius</i> Erichson, 1839*	NS	5	1	3	41
<i>Quedius scintillans</i> (Gravenhorst, 1806)		5	1	6	223
<i>Tasgius morsitans</i> (Rossi, 1790)		1	7	56	271
<i>Philonthus debilis</i> (Gravenhorst, 1802)*		1	0	22	176

Species * markedly culture-favoured	UK Status	Mill Bank	VC35	Wales	UK
<i>Philonthus parvicornis</i> (Gravenhorst, 1802)		1	0	4	56
<i>Philonthus discoideus</i> (Gravenhorst, 1802)*		1	0	2	78
<i>Bisnius cephalotes</i> (Gravenhorst, 1802)		1	1	19	156
<i>Cetonia aurata</i> (Linnaeus, 1761)*		5	0	62	772
<i>Gnorimus nobilis</i> (Linnaeus, 1758)*	NS	1	0	0	782
<i>Clambus punctulum</i> (Beck, 1817)*		1	0	14	104
<i>Clambus simsoni</i> Blackburn, 1902*	Naturalised	11	1	3	72
<i>Agrilus sinuatus</i> (Olivier, 1790)*		2	7	8	585
<i>Melasis buprestoides</i> (Linnaeus, 1761)		1	1	24	288
<i>Calambus bipustulatus</i> (Linnaeus, 1767)*	NS	1	0	26	99
<i>Megatoma undata</i> (Linnaeus, 1758)*	NS	1	0	3	263
<i>Ptinus sexpunctatus</i> Panzer, 1789*	NS	2	1	14	301
<i>Elateroides dermestoides</i> (Linnaeus, 1761)		1	4	87	377
<i>Cordylepherus viridis</i> (Fabricius, 1787)		1	0	171	1060
<i>Monotoma bicolor</i> Villa & Villa, 1835*		15	1	10	135
<i>Henoticus serratus</i> (Gyllenhal, 1808)		2	0	19	124
<i>Monotoma longicollis</i> Gyllenhal, 1827		4	0	4	105
<i>Cryptophagus scutellatus</i> Newman, 1834*		6	0	44	109
<i>Cryptophagus ruficornis</i> Stephens, 1830	NS	1	0	5	105
<i>Atomaria strandi</i> Johnson, 1967	NS	1	0	1	88
<i>Atomaria rubricollis</i> Brisout de Barneville, 1863*	NS	1	0	7	40
<i>Atomaria rubella</i> Heer, 1841*		176	3	283	1080
<i>Ahasverus advena</i> (Waltl, 1834)*		1	4	9	125
<i>Brassicogethes matronalis</i> (Audisio & Spornraft, 1990)*	NR	46	0	0	13
<i>Rhyzobius chrysoloides</i> (Herbst, 1792)*	Naturalised	8	2	4	1491
<i>Lycoperdina bovistae</i> (Fabricius, 1792)	NR	19	3	3	48
<i>Stethorus pusillus</i> (Herbst, 1797)		1	2	12	290
<i>Mordellistena pumila</i> (Gyllenhal, 1810)		5	7	40	204
<i>Nalassus laevioctostriatus</i> (Goeze, 1777)		1	0	177	1545
<i>Pseudocistela ceramboides</i> (Linnaeus, 1758)*	NS	3	6	5	130
<i>Stenostola dubia</i> (Laicharting, 1784)		1	4	33	414
<i>Crioceris asparagi</i> (Linnaeus, 1758)*		1	1	4	529
<i>Psylliodes laticollis</i> Kutschera, 1860		1	1	6	126
<i>Eutrichapion punctiger</i> (Paykull, 1792)		1	1	26	106
<i>Synapion ebeninum</i> (Kirby, 1808)		1	0	70	178
<i>Gymnetron melanarium</i> (Germar, 1821)	NS	1	1	2	103
<i>Ceutorhynchus sulcicollis</i> (Paykull, 1800)		1	0	38	131
<i>Otiorhynchus ligneus</i> (Olivier, 1807)		1	2	103	326
<i>Sitona ambiguus</i> (Gyllenhal, 1834)		1	3	38	115
<i>Caenopsis fissirostris</i> (Walton, J., 1847)	NS	3	0	13	60
<i>Hypera meles</i> (Fabricius, 1792)	NS	1	0	4	135
<i>Tropiphorus terricola</i> (Newman, 1838)	NS	2	3	41	134
<i>Magdalis ruficornis</i> (Linnaeus, 1758)		3	1	11	218
<i>Leiosoma oblongulum</i> (Boheman, 1842)	NS	3	4	6	46

SELECTED SPECIES OF COLEOPTERA

***Carabus monilis* Carabidae. BAP. NERC Act 2006, Sections 41/42:** Species of Principal Importance in England and Wales. Classified as endangered by IUCN (Telfer, 2016). A gravid female was on humid valley side grassland on 9 July 2013 (Fig. 4:6) with no further records despite monitoring. Scarce declined species of grassland and mixed grassland/open woodland biotopes, with recent suggestions of synanthropy on brownfield sites. In many parts of England *C. monilis* has shown a significant decline in association with land use intensification since the 1960s. Four VC records according to NBN Atlas

accessed October 2022. Apparent NBN atlas frequency peaks from about 1960 are probably artefacts due to inadequate monitoring of key sites before then (Whitehead, 1986). According to NBN atlas data (accessed 13 February 2023) average number of records per year over 28 years from 1990–2022 (some years had no records) was 8.5 in UK and 0.7 in Wales.

Perigona nigriceps Carabidae. **Naturalised synanthrope.** Culture-favoured tramp species little-known in Wales, most records from the larger southern conurbations. One record 18 September 2013 in dung and herb-based compost in hay meadow valley bottom. Although able to traverse open country in flight extensive areas of wild open country appear to limit its distribution.

Helophorus alternans Helophoridae. One in flight 20 June 2021. Dominantly coastal or estuarine in Britain with two VC records in 1994 (NBN atlas accessed 8 February 2023).

Sepedophilus bipunctatus Staphylinidae. In veteran alder trees along the Black Brook, a significant population in relation to Wales generally. This species burgeoned in England during the Elm Disease outbreak of the 1970s.

Cilea silphoides Staphylinidae. **Naturalised tramp species.** Like *Perigona nigriceps* this is a pantropical species evidently with few Welsh records. Able to disperse over open country e.g. to rural stable blocks.

Aleochara discipennis Staphylinidae. One example at sheep faeces on 16 May 2012. In Wales known mostly from mid-Wales with a recent record in 2012; possibly declining and regarded as rare by Welch (1997). Commonly on Bredon Hill, Worcestershire, VC37, between 110 m and 195 m a.s.l. during the 1990s but less commonly since.

Crataraea suturalis Staphylinidae. **Obligate synanthrope.** Amongst dry basal litter in hay shed, >700 on 20 May 2015. Only old Welsh records from the medieval farmstead site of Plas Gogerddan in 1990 and 1991 (NBN atlas accessed 2 December 2022). Mill Bank therefore has a pivotal role in the conservation of this key species. Occasionally in the non-intensive wider landscape in agricultural litter, very rarely in woodmould in traditional orchard fruit trees. According to NBN atlas data the UK population may be dwindling possibly as a result of greater agricultural ‘hygiene’. *Crataraea suturalis* has been a closely-aligned synanthrope for much of post last-glacial time (Clark, 1954; Cloutman & Smith, 1988; Carrott, Hall, Kenward & Large, 1994; Carrott, Fell, Large, Kenward & Kent, 2000; Hall, Kenward, Girvan & McKenna, 2007).

Oligota apicata Staphylinidae. Evidently becoming scarcer in Britain (NBN atlas accessed 3 December 2022) where there have been demonstrable population upsurges associated with outbreaks of the ascomycotine fungus *Cryptostroma corticale* (Ellis & Everh.) P.H. Greg. & S. Waller on Sapindaceae.

Oligota parva Staphylinidae. **Adventive thermophilous tramp species.** At least 38 in a warm grass heap on 19 June 2012. Apparently no published Welsh records during the previous 20 years.

Placusa tachyporoides Staphylinidae. Under bark of fallen cherry tree *Prunus avium* L., woodland edge, 13 May 2022. Five Welsh records all in 1996 (NBN atlas data accessed 7 January 2023) including a previous VC record from Llanover Park. In central Europe often subcortical on Coniferae in montane to submontane habitats.

Mocyta negligens Staphylinidae (Fig. 12). The genus *Mocyta* is an especially demanding one taxonomically, a view underpinned by specialists around the world. Small pale examples, the males with correspondingly small aedeagi, range across the herb-dominated parts of the south-facing slope and may occur especially in minerogenic sediment bands at the base of gritstone walls. Examples from sheltered humid niches on the south-facing valley side during September 2019 cannot yet be assigned. Klimaszewski *et al.* (2015) synonymised *Mocyta negligens* (Mulsant & Rey, 1873) with *Mocyta gilvicollis* (Scheerpeltz, 1949), representatives of which have considerable character width, including, for example, antennal morphology and colour. Comparisons have been made with examples determined by the compounded expertise of specialists including Mr A. A. Allen, Herr Jürgen Vogel and Dr Jyrki Muona. The aedeagi of these examples are small, short-necked and have internal sclerites converging apically (Fig. 12:2). The beetles may exhibit slender pale antennae but they may also be somewhat thickened and darker. The combination of pale straw-coloured elytra, orange pronota and

black heads is frequently striking (Fig. 12:1). At some sites populations of *Mocyta* spp. appear ‘plastic’ with hybridisation rendering species-level distinction difficult or impossible (Herr Jürgen Vogel, *in litt.*, 14 September 2019).



Fig. 12. The staphylinid beetle *Mocyta negligens* 2 September 2019. 1, female; 2, aedeagus illustrating the internal sclerites.

Medon apicalis Staphylinidae. In flight, 10 May 2016 with some wider evidence of spring dispersal. Possibly increasing away from British south-eastern strongholds, perhaps since 1980 (Boyce, 2022).

Rugilus similis Staphylinidae. Only at the Flowery Bank on 19 June 2012 and 21 September 2021. Unknown to Tomlin (1913) but a small spate of records in neighbouring Glamorganshire (SS79) in the 1990s especially at coastal sites around Ogmere. Subfossil record from Breiddin Hillfort, Montgomeryshire (Girling, 1991).

Quedius lucidulus Staphylinidae. **Recent colonist, new to Wales.** New to UK from Surrey in 2010 (Telfer, 2012) and from Huntingdonshire, East Kent, Sussex and Surrey; more recently from at least six other English VCs (Drewitt, Mann & Lane, 2021) and new to Scotland (Booth & Allen, 2022).

Cetonia aurata Scarabaeidae. **New to VC.** A beetle was at flowers of *Spiraea canescens* D. Don on 9 June 2006. On 12 May 2020 a beetle was observed in flight followed two days later by a beetle burying itself in a sheltered compost heap on the south-facing valley side. After further beetles were seen on 6 June 2020 a well-developed larva was encountered in a compost heap on 1 October 2020. This is important evidence for synanthropy with most Welsh records representing or originating from fixed dune populations (Fowles, 1994) or relict cliff-turf phenotypes (Whitehead, 2017) which have very recently been recognised in western Scotland.

Gnorimus nobilis Scarabaeidae (Fig. 13). **BAP. NERC Act 2006, Section 41: Species of Principal Importance in England. Here new to Wales** but note an earlier Holocene record (Tetlow, 2007). Like its congener *Gnorimus variabilis* (Linnaeus, 1758) this species is strongly tied to tanned heartwood and cavity *pabula* of broadleaved trees in both ancient woodland (Harvey *et al.*, 2018), traditional orchards (Alexander, 2008; Whitehead, 2001, 2003a, 2006, 2007; Whitehead & Whitehead 1999, 2000a, 2000b, 2001a, 2001b, 2002) and notably in other woody Rosaceae (Uff, 2019). A survey of eight Monmouthshire orchards (Whitehead & Whitehead, 2002) found that four had suitable habitat for *G. nobilis* and four did not; it concluded that widespread orchard fragmentation (a 94% loss of Welsh traditional orchards between 1958 and 1992 according to TACP Environmental Consultants, 1994) and habitat loss militated against the beetle with the likelihood also that it had no recent presence in those

orchards. A more recent survey (Whitehead, 2013) was conducted to assess the invertebrate significance of the Penallt woodlands which also included an examination of traditional orchard fruit trees at Mill Bank when no evidence of *G. nobilis* was found. It was again concluded that there were no populations of this species in Monmouthshire and probably not in Wales because no habitat existed on a scale large enough to support and drive a population.

That position was reversed on 21 July 2021 when a head-high cavity of damp friable woodmould was encountered in the bole of the rare desert pear *Pyrus communis* Linnaeus cv. ‘Betty Prosser’ (Martell, 2013). The woodmould contained evidence of a reasonably distinctive entomofauna and a large number of larval faecal pellets of *G. nobilis* in a *pabulum* perfect for that species. It is believed that those larvae were well-developed and that colonisation occurred within the previous 30 or so years. No evidence of adult beetles was found but several fragments of scarabaeid larval mandibles including incisiform and molariform dentition were recovered. Although the author maintains a reference collection of scarabaeid larval dentition these examples could not be identified because they represented early larval instars.

This raises the question of how colonisation occurred, and whilst isolated fringe populations of *G. nobilis* do exist, for example in only one tree out of 40 sampled at Bredon’s Hardwick, Worcestershire (Whitehead & Whitehead, 2000a) it is entirely possible that this finding stems from a more mobile representation of the well-known Gloucestershire population (Atty, 1983; Whitehead & Whitehead, 2000b, 2001a). It is unclear that the Mill Bank breeding population was successful; the evidence suggests that it was short-lived and not maintained. However a large unidentified metallic green scarabaeid beetle was observed flying in full sun from a moving vehicle near Mill Bank (51°78'N 2°69'W SO517070 200 m a.s.l.) at 1000 hrs on 7 July 2013. During September 2022 a ‘Wye Valley AONB Partnership’ issued a six sheet report of a lure-trapping scheme for *G. nobilis* conducted during June and July 2022 within that AONB concluding that no *G. nobilis* were trapped in Monmouthshire. Since 2016 *G. nobilis* has been the subject of a successful captive breeding programme at Copenhagen Zoo (Ellegaard & Bach, 2020).

Note: the generic name *Aleurostictus* Kirby, 1827, available when employed here in references, was suppressed by Opinion 2186 (Case 3349) in 2007 (*Bulletin of Zoological Nomenclature* 64(4), December 2007, p. 265).

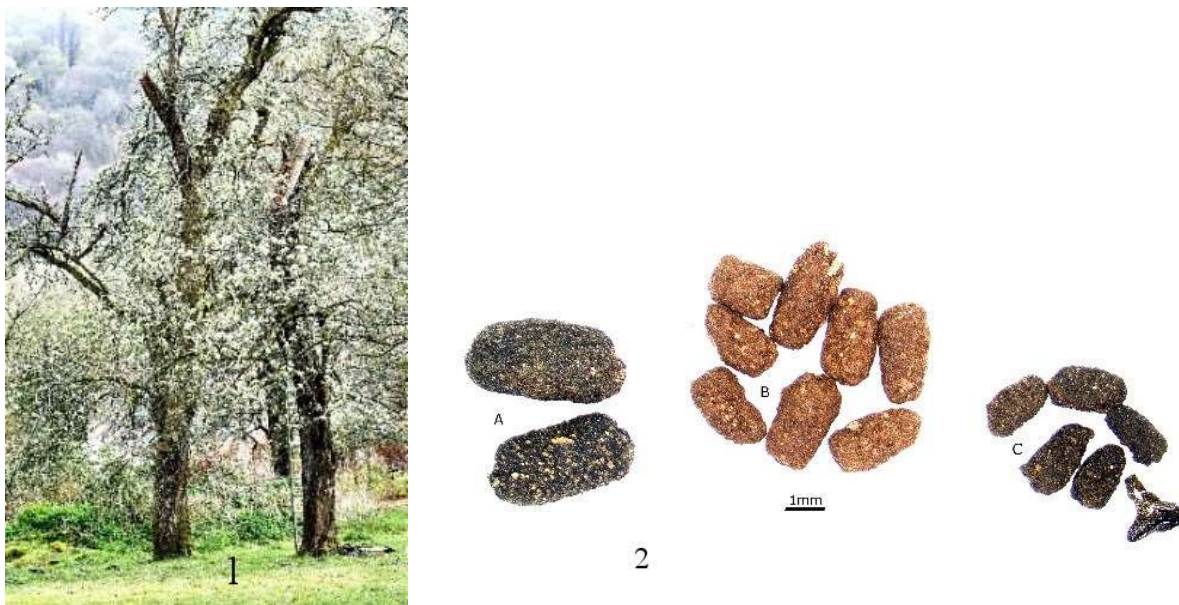


Fig. 13. 1. Veteran cultivated pear trees in Isaac’s Field with a diverse range of habitats recently occupied by Noble Chafer *G. nobilis*, 13 April 2022; 2. Faecal pellets of scarabaeid beetles known to breed at Mill Bank; A. Subcylindrical fusiform pellets of Rose Chafer *C. aurata* (Anglesey, 2011); B, C. Attenuated flattened tabular pellets of Noble Chafer. B. Mill Bank 2021; C. Minsterworth, Gloucestershire, 2006 with isolated hypomeron of adult beetle.

Calambus bipustulatus Elateridae. One record *viz.* remains of an adult in a dry cavity in a pear tree *Pyrus communis* L. cv. 'Blakeney Red' on 24 August 2012, possibly as a predator of ptinid beetles in dry cavities, a family of beetles well represented in the tree. Increasingly rare in Wales with populations centred on historic sites such as Dinefwr Deer Park (Hammond & Hine, 1994). The Holocene pedigree (4830 +/- 100 BP) of this species in Britain was confirmed by Kelly & Osborne (1965).

Atomaria rubricollis Cryptophagidae. One record on 2 September 2019. This species is evidently a **relict of well-drained ancient grassland** (Johnson, 1993; Whitehead, 1993) and is regarded here as an early clearance species possibly associated with minerogenic sediments exposed by millstone production.

Brassicogethes matronalis Nitidulidae. **New to Wales.** First found on Dame's Violet *Hesperis matronalis* Linnaeus on 7 June 2014 with 40 beetles present on 19 May 2022. *Brassicogethes matronalis* was described relatively recently and in the larval stage is monophagous on *H. matronalis* and in Caucasian areas on *Hesperis transcucasica* Tzvelev (Audisio *et al.*, 2011). It was added to the British entomofauna by Booth (2012).

Lycoperdina bovistae Endomychidae. **NR Nationally Rare.** There are few published Welsh records of *L. bovistae*. On 19 May 2022 12 larvae and pupae were collected from sporocarps of the puffball *Lycoperdon nigrescens* Pers. in the Black Brook valley. All the larvae pupated and all eclosed simultaneously during the night of 4 June 2022.

Stenostola dubia Cerambycidae. Remains of one in woodmould in bole cavity of the pear *Pyrus communis* L. cv. 'Blakeney Red' on 24 August 2012. Associated with physiologically weakened branch and young coppice growths in a range of hardwood trees including lime *Tilia* spp. which are well represented in the Wye Valley woodlands. A Holocene climax woodland pedigree (4670BP +/- 160 BP) was confirmed by Smith *et al.* (2005). The ichneumonid wasp *Dolichomitus pterelas* (Say, 1829) (Fig. 14) is believed to parasitise this species.

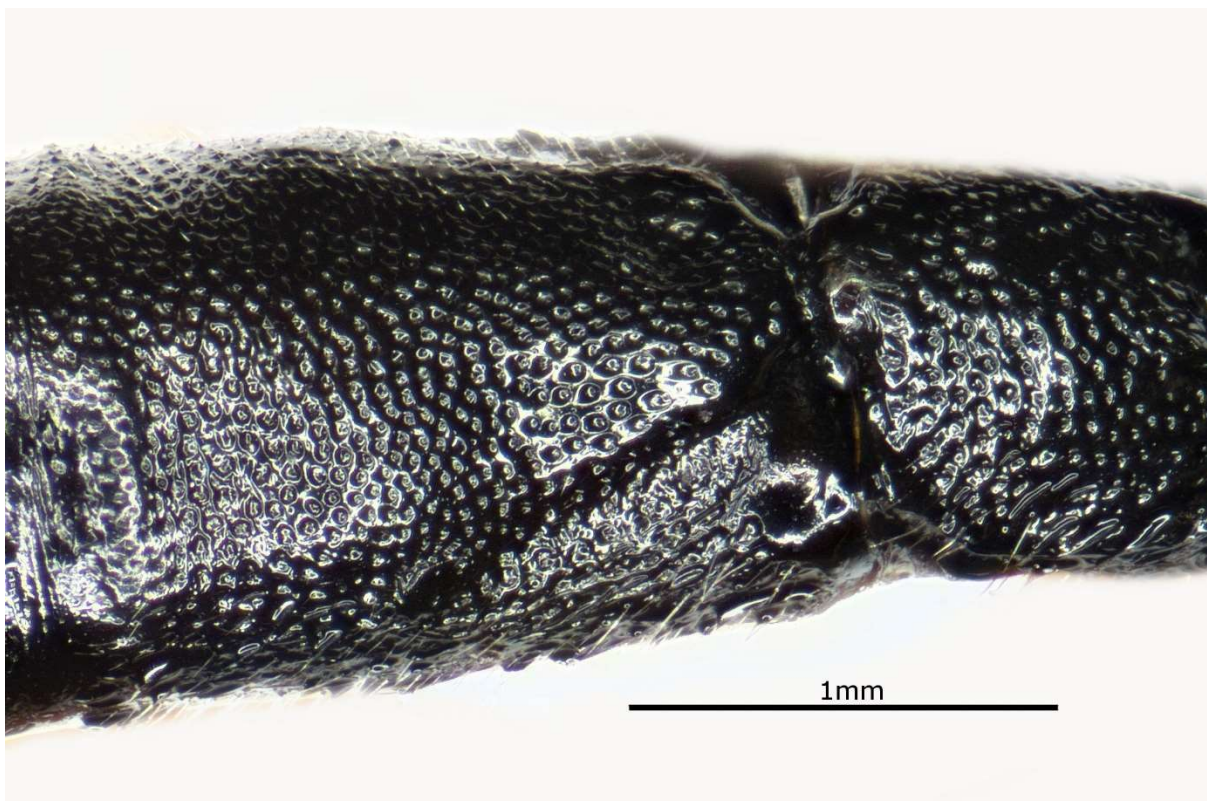


Fig. 14. Right lateral view of tergites one and two of the ichneumonid wasp *Dolichomitus pterelas* observed in flight on 23 September 2022 and scarcely known in Wales. A parasitoid of the cerambycid beetle *Stenostola dubia*.

Synapion ebeninum Apionidae. One on alpine strawberry *Fragaria vesca* L. on floristically rich south-facing rock outcrop 19 June 2012. In Wales 16 records since 2000 and none since 2018 (NBN atlas accessed 9 January 2023). Seemingly increasingly scarce in Britain although widely scattered usually on herbaceous Fabaceae especially *Lotus* spp. (Fowler, 1890; Morris, 1990) and in Ireland on *Vicia sepium* L. (Morris, 1992).

Gymnetron melanarium Curculionidae. One on floristically rich south-facing rock outcrop 20 August 2019. One VC record in 1994 (NBN atlas data accessed 8 January 2023). Usually forms galls in stems of grassland *Veronica* spp. more frequently in southern and south-eastern Britain.

Sitona ambiguus Curculionidae. **Downgraded from Notable (Hyman, 1992) perhaps unjustifiably.** One swept on Flowery Bank on 19 May 2022, three previous VC records between 1997 and 1999. Four Welsh records during the past 15 years (NBN atlas data accessed 8 January 2023) with an average of one per year during the last 30 years. Larvae oligophagous at the roots of herbaceous Fabaceae (Morris, 1997). Rather rare and possibly in decline with UK records averaging two per year during the past 50 years.

Leiosoma oblongulum Curculionidae. Seemingly **increasingly scarce generally** and limited at Mill Bank to sheltered humid spots on and upslope of the Flowery Bank with three records during 2012 and 2019 suggesting that the resident population is small. Four previous VC records all in 1997 (NBN atlas accessed 7 January 2023).

The Stag Beetle ***Lucanus cervus*** Linnaeus, 1758 Lucanidae. A single exceptionally large lucanid larva was encountered on 9 July 2013 between the contact of a fallen apple tree bole and the ground. At the time all of the details suggested *Lucanus cervus*. Recent detailed examination of the dentition indicates that this larva represents *Dorcus parallelipedus* (Linnaeus, 1758) which can occasionally reach very large size (Hendricks, 2013) and in relation to fallen trees can feed externally. An unconfirmed report is of a male *L. cervus* observed near a house 758 m south-south west of Mill Bank during the night of 1 August 2013. The most conclusive but indirect evidence of *L. cervus* comes from the western oak woods of Pwll-Mawr 560 m north-west of Mill Bank. Here a deeply-bedded stump of Sessile Oak *Quercus petraea* (Matt.) Liebl. extirpated by the author on 13 August 2013 had its indurated root bases intensively carved apparently by larvae of *L. cervus*. Tomlin (1914) regarded *L. cervus* as a great rarity in Glamorgan from where NBN Atlas (accessed 5 January 2023) details 51 records. Monmouthshire has 14 records attributed to it so that an existence in the Trellech wildwoods is or was likely. Data provided by Whitehead (2013) requires some amendment in the light of these findings.

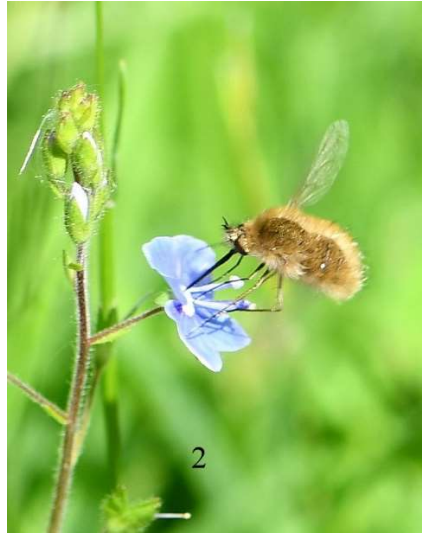


Fig. 15. Insect diversity at Mill Bank. 1. Flowers of cultivated plants such as *Cynara cardunculus* L. are strongly favoured by aculeate Hymenoptera; 2. *Bombylius canescens* Mikan during June 2021, a summer species hosted by mining bees; 3. A female ichneumonid wasp *Enclisis alpicola*, 20 August 2019; 4. The ichneumonid wasp *Rhyssa persuasoria* (Linnaeus, 1758) ovipositing in larch *Larix kaempferi* (Lamb.) Carrière on 17 May 2012; 5. Frons of the recently described nocturnal ichneumonid wasp *Ophion tenuicornis* Jansson, 2019, 6 November 2021; 6. *Sapyga quinquepunctata* (Fabricius, 1781) at its nest hole in a fallen apple tree on 19 May 2022.

HYMENOPTERA: BEES WASPS AND ANTS

HYMENOPTERA PARASITICA

Discussion of this group of parasitic wasps is limited. Despite major British literature contributions spanning 60 years it remains challenging to non-specialists. While the distribution of some species may be known in broad terms statuses often are not. *Enclisis alpicola* (Habermehl, 1926) (Fig. 15:3), omitted from Schwarz & Shaw (1998), may be genuinely rare. *Stauropoctonus bombycivorus* (Gravenhorst, 1829) may be restricted to better quality habitats, matters requiring confirmation.

TABLE 7. MILL BANK HYMENOPTERA PARASITICA RECORDED TO END OF 2022. SPECIES WITH LESS THAN FIVE VC RECORDS OR LESS THAN 20 WELSH RECORDS BASED ON NBN ATLAS DATA (ACCESSED 21 JANUARY 2023)

Family and species	Primary host or reference	Mill Bank records	VC records	Welsh records	Mill Bank location
Gasteruptiidae					
<i>Gasteruption jaculator</i> (Linnaeus, 1758)	Aculeata	1	2	18	In flight 7.2022
Megaspilidae					
<i>Lagynodes pallidus</i> (Boheman, 1832)	Broad & Livermore 2014	1	0	0	On pasture 5.2012
Diapriidae					
<i>Basalys tuberculatus</i> (Kieffer, 1911)	Diptera	2	0	1	Wall base 9.2019
<i>Belyta sanguinolenta</i> Nees, 1834	Diptera	1	0	?	Frangula 7.2016
<i>Spilomicrus hemipterus</i> Marshall, 1868	Notton 1999	1	0	0	Wall base 9.2019
Cynipidae					
<i>Andricus curvator</i> Hartig, 1840	<i>Quercus</i>	1	2	34	In flight 4.2016
Pteromalidae					
<i>Cyrtogaster vulgaris</i> Walker, 1833	Agromyzidae	1	0	4	House wall 5.2022
Ichneumonidae					
<i>Agriotypus armatus</i> Curtis, 1832	Trichoptera	1	0	14	Fontinalis brook 5.2012
<i>Barylypa propugnator</i> (Förster, 1855)	Lepidoptera	1	0	0	Hayfield 7.2016
<i>Diphyus quadripunctorius</i> (Müller, 1776)	Noctuidae	1	0	1	In flight 6.2021
<i>Dolichomitus pterelas</i> (Say, 1829)	Cerambycidae	1	0	0	In flight 9.2022
<i>Enclisis alpicola</i> (Habermehl, 1926)	Schwarz 1989	1	0	0	South house wall 8.2019
<i>Enicospilus combustus</i> (Gravenhorst, 1829)	Noctuidae	1	0	6	MV light 9.2022
<i>Enicospilus ramidulus</i> (Linnaeus, 1758)	Noctuidae	2	0	6	MV light 8.2022
<i>Gelis agilis</i> (Fabricius, 1775)	Schwarz & Shaw 1999	2	1	4	Grassland 2012-2015
<i>Gelis bicolor</i> (Villers, 1789)	Araneae	5	1	1	General 2013-2016
<i>Gelis melanocephalus</i> (Schrank, 1781)	Araneae	1	0	1	Woodland 4.2022
<i>Gelis proximus</i> (Förster, 1850)	Schwarz & Shaw 1999	1	0	0	Hay 9.2019
<i>Gelis spurius</i> (Förster, 1850)	Lepidoptera	6	0	0	Hay 2012-2013
<i>Ichneumon extensorius</i> Linnaeus, 1758	Noctuidae	1	0	6	In flight 10.2016

Family and species	Primary host or reference	Mill Bank records	VC records	Welsh records	Mill Bank location
<i>Ichneumon stramentor</i> (Gravenhorst, 1802)	Noctuidae	2	2	17	Garden 3.2012 6.2013
<i>Netelia pallescens</i> (Schmiedeknecht, 1910)	Thyatiridae	2	0	0	MV light 11.2021
<i>Netelia virgata</i> (Geoffroy, 1785)	Geometridae	3	0	0	MV light 9.2017, 8.2022
<i>Netelia infractor</i> Delrio, 1971	Noctuidae etc	4	0	1	MV light 9.2017, 8.2022
<i>Netelia terebrator</i> (Ulbricht, 1922)	Geometridae	2	0	0	MV light 8.2022
<i>Opheltes glaucopterus</i> (Linnaeus, 1758)	Cimbicidae	1	0	3	MV light 10.2021
<i>Ophion luteus</i> (Linnaeus, 1758)	Noctuidae?	4	2	2	MV light 4.2014, 8.2022
<i>Ophion mocsaryi</i> Braun, 1889	Noctuidae	3	0	0	MV light 6 & 10.2021
<i>Ophion parvulus</i> Kreichbaumer, 1879	Thyatiridae	1	0	0	MV light 9.2017
<i>Ophion tenuicornis</i> Johansson, 2019	Thyatiridae	1	0	0	MV light 11.2021
<i>Pimpla rufipes</i> (Miller, 1759)	Lepidoptera	1	3	44	In flight 9.2015
<i>Stauropoctonus bombycivorus</i> (Gravenhorst, 1829)	Notodontidae <i>Stauropus</i>	2	0	0	MV light 9.2017, 8.2022

HYMENOPTERA ACULEATA

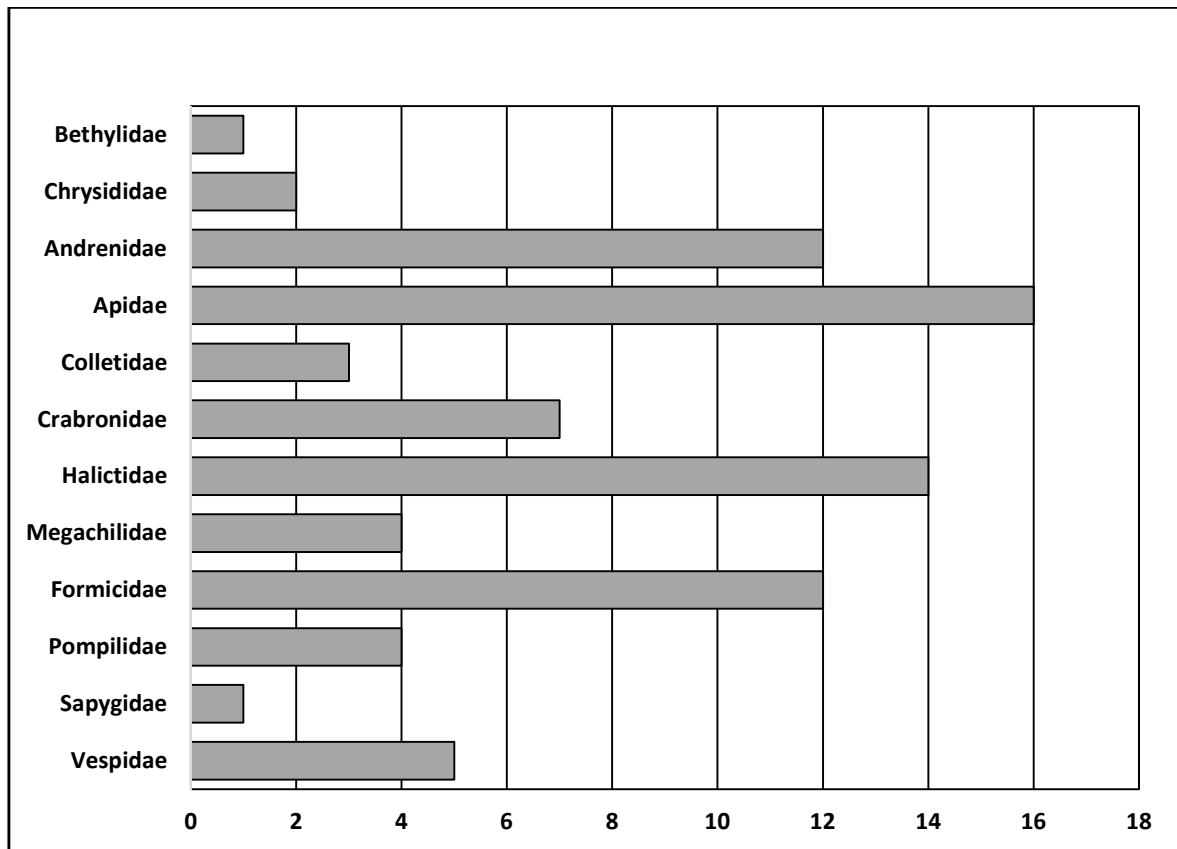


Fig. 16. Mill Bank. The representation of 81 species of aculeate Hymenoptera in 12 families up to the end of 2021.

A key and very obvious element of the Mill Bank entomofauna is its **aculeate Hymenoptera** (Fig. 16) which in terms of site occupancy is better understood than the Hymenoptera Parasitica. Many of the 85 known species are highly visible and range widely over the site. On the well-drained south-facing slope nests of mining bees are scarcely short of contiguous in some places. There is a particular abundance of halictid and andrenid bees (Table 8) with an attendant suite of seven species of cleptoparasitic *Nomada* spp. *Nomada lathburiana* (Kirby, 1802) is no longer the scarce species it once was and its spring appearance coincides closely with that of its increasingly widespread host *Andrena cineraria* (Linnaeus, 1758) sometimes seen as early as 25 March visiting Windflowers *Anemone nemorosa* L. Most of the 12 species of *Andrena* are widely distributed in Wales and favour the thin minerogenic soils draped over bedrock especially where the sward is mown.

Andrena subopaca Nylander, 1848 prefers the thinly vegetated south-facing woodland edges and in May their nesting grounds shimmer with *Nomada flavoguttata* (Kirby, 1802). Some species are more localised and nests of *Andrena bucephala* Stephens, 1846, a species with few VC records, were first observed on 30 April 2019 together with its cleptoparasite *Nomada hirtipes* Pérez, 1884. *Andrena labiata* (Fabricius, 1781) has only four VC records and was first recognised at Mill Bank on 7 September 2022 its site status requiring further clarification. *Andrena angustior* (Kirby, 1802) attended by *Nomada fabriciana* (Linnaeus, 1767) is also localised in Monmouthshire.

Halictidae are represented by nine species of *Lasioglossum* and four species of *Sphecodes*. The Hayfield supports large populations of the larger *Lasioglossum* spp. and *Lasioglossum calceatum* (Scopoli, 1763) nests commonly on the terraces beneath the house where it is accompanied by *Sphecodes monilicornis* (Kirby, 1802); this latter species, together with *Sphecodes gibbus* (Linnaeus, 1758), also parasitises *Halictus rubicundus* (Christ, 1791) (Falk, 2015). The terrace walls are colonised intensively by the smaller *Lasioglossum* species especially *Lasioglossum morio* (Fabricius, 1793) and *Sphecodes* spp. may be abundant here including *Sphecodes ephippius* (Linnaeus, 1767) which is also catholic in its choice of bee hosts. These species of *Sphecodes* are widespread in Wales but *Sphecodes ferruginatus* von Hagens, 1882 recorded on 30 April 2019 is much scarcer with a single VC occurrence attributed to Perkins in 1897. *Halictus rubicundus* and *Halictus tumulorum* (Linnaeus, 1758) are both widespread in Wales and are well represented amongst the breeding bees of Mill Bank.

Osmia bicornis (Linnaeus, 1758) preferentially nests in the barn walls where it is accompanied by *Melecta albifrons* (Förster, 1771) but the nest sites of *Osmia leaiana* (Kirby, 1802) have not yet been found. The *Osmia* parasite *Chrysura radians* (Harris, 1776) was observed on 24 June 2015; that the VC appears to be a Welsh focus for this species may be explained in part by observer bias. *Chrysis ignita* (Linnaeus, 1758) occurs commonly. Six species of bumblebee include a large female *Bombus muscorum* (Linnaeus, 1758) overflying the site on 6 June 2021. This diverse fauna of aculeates attracts bee-predators including *Cerceris rybyensis* (Linnaeus, 1771) that has for long nested in insulated compacted sediments around the house. The Bee Wolf *Philanthus triangulum* (Fabricius, 1775) was observed for the first time on 23 April 2021. The burgeoning population of the localised oil beetle *Meloe rugosus* is enhanced by the nine species of aculeate Hymenoptera that are known to transport triungulins (Rabjohns & Whitehead, 2022).

Mill Bank accommodates 12 species of ants and is a Welsh hot-spot in this regard. Some species are immediately obvious in the field but one which is not is *Lasius platythorax* Seifert, 1991, so far limited to a single nest containing notably large workers. This was discovered on 2 September 2019 against one of the terrace walls which acts as a heat sink. In Wales this species has a marked coastal affinity; according to NBN atlas data (accessed 22 January 2023) there is one previous VC record. Nests of *Formica fusca* Linnaeus, 1758 may exceed 3000 workers; one can only imagine their impact on the invertebrate fauna and what this may convey with regard to carrying capacity. It is a point of interest that *F. fusca* nests almost exclusively on the south-facing slope while *Formica lemni* Bondroit, 1917 is confined to the north-facing slope especially in the orchard environment.

Myrmica rubra (Linnaeus, 1758) is ubiquitous and very large numbers of nests can be observed in the hayfield prior to mowing; >6000 workers have been encountered on a single July day which makes a strong statement for the vigour of the system. This species also commonly constructs nests in mole

hills. *Myrmica rubra* is strongly associated with the orchard biotope and colonies have been observed up to four metres high in veteran pear trees where workers sometimes raid cavities and woodmould seams. The adaptability of this ant was demonstrated by a large nest discovered in a pile of wool shorn from Balwen Mountain Sheep. *Myrmica ruginodis* Nylander, 1846 is much less obvious although widely dispersed. It is the only ant to have nested amongst *Sedum album* L. on the green roof of a summer house.

Nests of *Lasius mixtus* (Nylander, 1846) are few and subterranean, usually under rocks in the orchards or pastures and there are evidently few documented VC records. A single nest was found intermingled with a nest of the ubiquitous *Lasius flavus* (Fabricius, 1781) in a buried plastic water pipe on 1 September 2019. *Leptothorax acervorum* (Fabricius, 1793) has occurred throughout especially in anthropogenic contexts with nests in the service garden and amongst timber around the edges of compost heaps. Like *Lasius platythorax*, *Myrmecina graminicola* (Latreille, 1802) has coastal affinities in Wales and like that species it occurs at Mill Bank in small numbers especially in the shelter of the higher terrace walls. It is thought that nesting takes place there, the workers frequently foraging along the wall bases. The stone walls appear to be used by *M. graminicola* workers as conduits of dispersal into the south-facing valley side. Less frequently they make incursions into low-level bole cavities in the veteran fruit trees on the north-facing valley side and may nest in association with them.

A single *Stenammina debile* (Förster, 1850), apparently highly localised in Wales (NBN atlas data accessed 22 January 2023) was found amongst moss on a gritstone monolith in The Dingle on 13 April 2022. *Temnothorax nylanderi* (Förster, 1850) is also apparently highly localised in Wales (NBN atlas data accessed 22 January 2023) and certainly is at Mill Bank. A small nest was found in the fallen crown wood of an apple tree on 14 August 2013.

The pompilid wasps *Dipogon subintermedius* (Magretti, 1886) and *Dipogon variegatus* (Linnaeus, 1758) both occur at Mill Bank, the former a specialist parasitoid of segestriid spiders on orchard fruit trees. It is not clear whether the scarcity of *D. subintermedius* in Wales is real or apparent. *Dipogon variegatus* has been observed using the terrace wall-bases as an effective way of locating its prey namely spiders of the genus *Xysticus*. The single nesting record of the sapygid wasp *Sapyga quinquepunctata* (Fabricius, 1781) was in the bole of a dead fallen apple tree *Malus domestica* (Suckow) Borkh. cv. 'King of the Pippins' on 19 May 2022 (Fig. 15:6). The vespids *Ancistrocerus gazella* (Panzer, 1798) occur around the house and *Ancistrocerus nigricornis* (Curtis, 1826) was proven to nest in its wall-joints on 29 April 2015. The house is especially attractive to vespids and hornets *Vespa crabro* Linnaeus, 1758 have also nested against its walls.

CONCLUSION

This account provides some insight into the invertebrate life of a traditional highly-integrated operational smallholding in south-east Wales. It is an unashamedly faunistic statement hallmarking the merits of small data. The biota of Mill Bank exists by default despite major historical land use change. It does not result from positive targeted conservation practice but is an expression of a sustainable system at a site of great character in the Welsh borderlands, a truly wild place. In terms of Biodiversity Action Plan species it has with a large measure of success sustained six species of birds, three species of reptiles, three species of amphibians, four species of butterflies, 17 species of moths, a majority under the BAPRe designation (Anon., 1995; Conrad *et al.*, 2006; Fox *et al.*, 2006; Parsons *et al.*, 2005) and three species of beetles as well as a considerable number of NERC Act (2006) Section 42 species. Five species of bats use its built structures and two other species visit.

The garden at Mill Bank is not a garden in the commonly understood sense of having definable boundaries. Instead its cultivated plants, some of which are native species, tend to diffuse into the wider landscape not unlike many south European gardens. These plants are used extensively by a range of pollinating insects and act as support systems for many invertebrates, especially bees. Gardens that function in this way may have a strong positive influence on the regional biota; at Broadway in Worcestershire a semi-natural garden developed on land with at least eight centuries of cultivation accommodated 756 species of beetle (Whitehead, 1992). At Mill Bank, as at Broadway,

invertebrates use the periphery of the house, the walls of the house and the interior of the house as they have done since houses were first built.

Most readers of this account will have some awareness of the state of the planet (Meadows, Randers & Meadows, 2020) and its entomofauna (Hallmann *et al.*, 2017; Harris, Rodenhouse & Holmes, 2019; Møller, 2019; Raven & Wagner, 2021; Sánchez-Bayo & Wyckhuys, 2019; van der Sluijs, 2020; Wagner *et al.*, 2021), this last a problematical matter that generally remains unresolved. In the English lowlands there is no visible evidence to suggest that the National Planning Policy Framework has yet mitigated for the diminution of the biota as a consequence of intensive built development. Corridors and similar avenues of mitigation (Samways, 2005) are fine in principle but the target biota first has to exist! It has been demonstrated that at Mill Bank existence is not a problem.

Writing almost a quarter of a century ago Hawksworth (2001) stated: “The last 25 years has seen a transformation in the state of knowledge of the distribution, abundance and ecology of many species. Such knowledge provides a basis for which sounder conservation action can now be based.” Would he still be impressed today? Seventy five years earlier the inaugural meeting of the Council for the Preservation of Rural England opined: “The man who builds a cottage in open countryside or in a village, the Local Authority that creates a new village, the industrialist who erects a factory must realise that he owes a duty to that country.” At Mill Bank the consequences of that duty are plain to see thanks largely to the enterprise of past, and in particular, present families that have understood and enhanced its role by a continuum of thoughtful carefully considered sympathetic management in increasingly changing times.

ACKNOWLEDGEMENTS

The author expresses particular gratitude to Mr I. P. Rabjohns for making this account possible and for providing an abundance of practical support. Apart from the specialists mentioned in the text Dr Gavin Broad (NHMUK) kindly confirmed the identity of some nocturnal ichneumonids and Mr Roger Ruston (Monmouth) contributed some observations on aculeate Hymenoptera. Mr Maxwell V. L. Barclay (NHMUK) discussed the concept of *Leiosoma deflexum* (Panzer, 1795) var. *collare* Rye, 1873. Mr S. Bosanquet (Dingestow) kindly identified Bryophytes and assisted with some microlepidoptera identifications.

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