

**The aculeate bees & wasps of the Sandwell Valley RSPB with special reference to the solitary species found on the Bee Bank by the Lake Hide**



*Andrena cineraria* (Ashy Mining Bee) on the Bee Bank © A.Purcell

Michael Bloxham

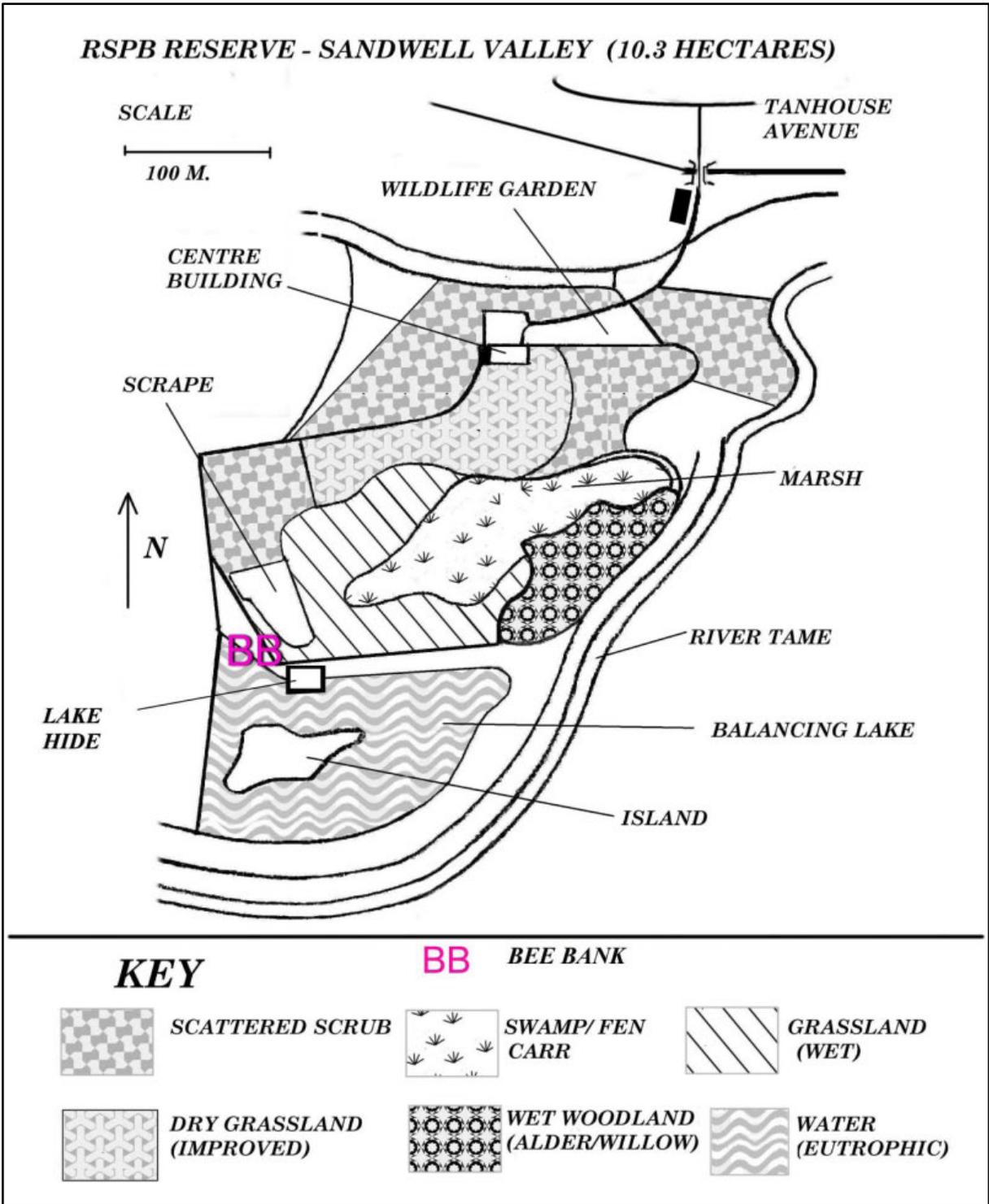
St John's Close, West Bromwich

September 2015



*Sandnats*  
Sandwell Valley Naturalist's Club

A map of the Reserve



## Introduction

The RSPB Reserve Sandwell Valley (Grid ref. SP032927 –Map on page 2) is situated close to the junction of the M5 and M6 motorway in Sandwell, covers an area of approximately 10.3 ha and contains many different habitats, each providing conditions suitable for a wide variety of wildlife. More than half of the total number of plants found in Sandwell Valley has been recorded from the Reserve since it opened in 1983 and intimately associated with these are numerous invertebrates. So far, around 700 different species have been recorded and amongst these has been a sizeable set of aculeate bees and wasps. The results of a preliminary investigation to find the nesting sites of these insects are found in this report.

- **Background information and Site details**

A steel hide was constructed on the north margin of the Sandwell Valley Balancing Lake during 2004 thanks to a most generous grant. This was reached down a well - surfaced path from the RSPB building, the final 50 metres having to be cut out through an existing bank of local clay- based soil (with some sandy elements). The path and adjoining bank are exposed to warm sunshine for much of the day, having a southerly aspect. A photo below gives a general impression of the hide and the bee bank where the survey work was done.



It was necessary to maintain this path so the public could readily gain access to the hide (see barrow etc). Over the course of time visitors and volunteers reported increasing insect activity on an adjoining area of some 30 square metres of sandy bank.

A preliminary visit suggested that most of the insects were solitary aculeate bees and wasps ('solitary' means not being a member of a colony with a queen and **aculeate** means 'having a sting').

**Colin Horne** (Reserve Manager) and his successor **Lee Coppelstone** decided that it was important to discover more. Sandwell Valley Naturalists' Club took up the challenge and in 2009 **Mike Bloxham** undertook a survey of the bank and its inhabitants.

- **The aims of the survey**

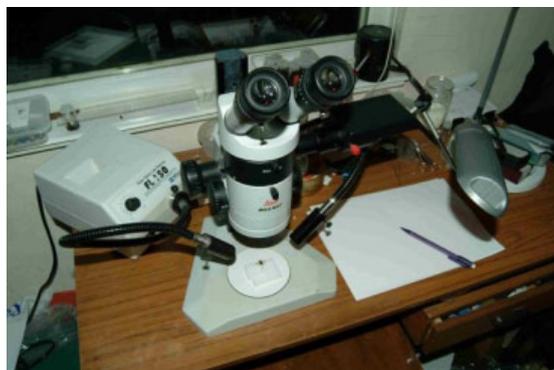
This was an empirical survey intended to identify the solitary bees and wasps, together with associated insects found on the Bee Bank and to record basic observations on their establishment there in the context of some current knowledge about their lives.

- **Methodology**

The study of adult solitary bees and wasps presents its special difficulties. In general, sunshine is important to ensure that they come out in numbers to perform essential tasks such as nest-making, foraging for pollen, nectar and other food sources needed for the sustenance of adults and development of immature stages. This need for warm and sunny weather meant that visits sometimes had to take place at fairly short notice. It has to be emphasised that adverse weather conditions (clouds, showers and winds) affected a number of visits and these were not always recorded in the notes. The period of active survey was therefore variable.

For each visit a period of some 60 minutes was devoted to observing and sampling the target insects and making general observations of activity in the vicinity of the nest holes. Other invertebrates associated with them were also observed and sampled.

During the work the observer tried to tread on the sand and soil at the base of the bank as little as possible, because this housed a number of smaller aculeates. At no time was there any disturbance of the burrow systems established in the bank by the target species. This could be important for future studies planned to further investigate these.



It must be emphasised that identification of most aculeates requires detailed examination and very few can be confidently named in the field. Therefore specimens were collected by tube, sweep net and hand search. They were examined using a Leica M3Z microscope (picture above) and whilst some could be taken back to the reserve and released, a number were retained in a reference collection.

Photography was regularly used during the survey, both to record behaviour of interest on site and to show where this took place, to assist RSPB staff and volunteers for conservation purposes. It also provided a visual record of some significant finds for publications. We are indebted to **Andy Purcell** for expert assistance in this.

- **Visits**

Over the survey period, 47 visits have been made to the bank. A reasonably good coverage of the months when the insects are likely to be active has been attempted, but for various reasons some years have seen little survey. The table on page 5 gives a summary of monthly visits.

YEAR	March	April	May	June	July	August	September
2009	1		3	3		5	2
2011	1	4	3	4	2		1
2012							1
2013					1		
2014	1	1	1		3	1	
2015		2		4	1	2	
<b>TOTAL</b>	<b>3</b>	<b>7</b>	<b>7</b>	<b>11</b>	<b>7</b>	<b>8</b>	<b>4</b>

- **Summary of Records Accumulated and Species Discovered**

202 records of Hymenoptera have been recorded for the entire RSPB Reserve.  
 Of these, 178 were records of Aculeate bees and wasps gathered during this survey  
 60 Aculeate bee and wasp species have been recorded for the reserve as a whole.  
 Of these, 46 species were observed at the Bee Bank. Another was assumed to be present.  
 A full aculeate species list for the entire Reserve is given in the appendix.

**The solitary bees of the bank and some additional insects associated with them.**

**Andreninae (*Andrena*)**

Many of these are **fossorial** (making nest holes in bare earth in suitable areas). Newly emerged females mate and then forage, collecting pollen from seasonal plants for storage in the nest cells. Developing larvae feed on this. Many of the bees are reasonably large and being robust and strong fliers, rapidly find suitable new habitats.

Species	Months recorded at RSPB	Location
<i>Andrena bicolor</i>	June	on central area
<i>Andrena cineraria</i>	April and May	most bare areas on the bank (picture below)
<i>Andrena clarkella</i>	March and April (one in May)	most bare areas on the bank
<i>Andrena fulva</i>	April	uppermost grassy fringe
<i>Andrena haemorrhhoa</i>	April	most bare areas on the bank
<i>Andrena minutula</i>	End of March	lower areas where eroded sand is present
<i>Andrena nigroaenea</i>	April May & early June	most bare areas on the bank
[ <i>Andrena praecox</i> ]	Not seen (cleptoparasite present)	unknown
<i>Andrena nitida</i>	April and May	uppermost grassy fringe
<i>Andrena carantonica</i>	August	most bare areas of the bank
<i>Andrena semilaevis</i>	June	lower areas where eroded sand is present
<i>Andrena subopaca</i>	April, May and June	lower areas where eroded sand is present



Two of the bee bank's inhabitants: the grey mining bee (*Andrena cineraria*) and the rare Nomad bee (*Nomada ferruginata*)

## Anthophorinae (*Nomada* species)

These are cleptoparasites – they enter the nests of other bee species and lay eggs there. The larvae develop using the food stores gathered by the host species and may harm host larvae. Their flight period coincides with that of the hosts and they frequent the same nesting areas. The table following names only the likely host species recorded on the bee bank (using information from literature).

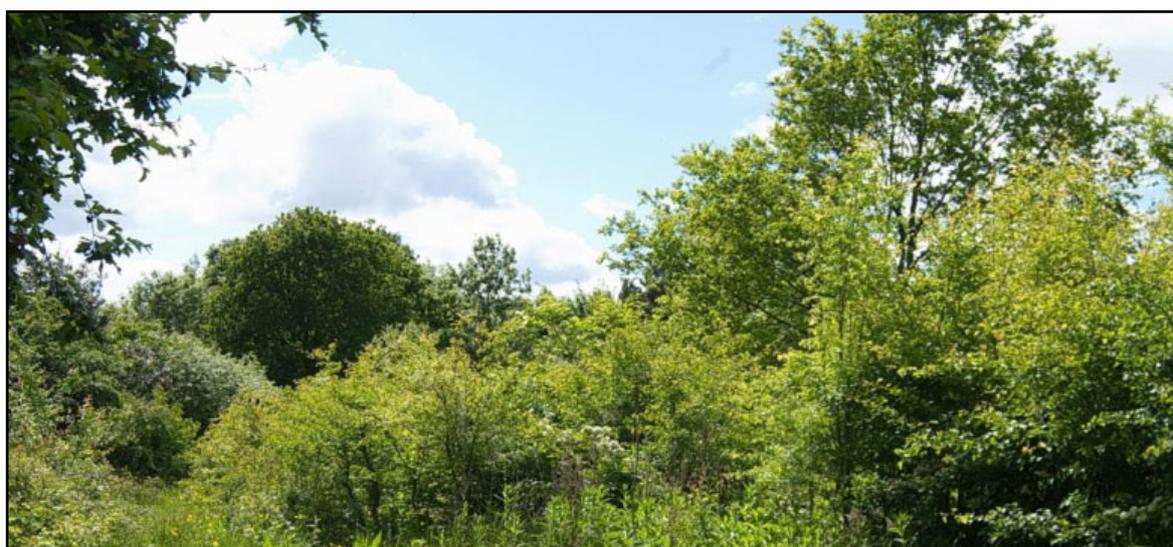
Species	Host Bee	abundance
<i>Nomada fabriciana</i>	<i>Andrena nigroaenea</i>	few
<i>Nomada flava</i>	<i>Andrena carantonica</i> (? <i>A. nigroaenea</i> & <i>A. nitida</i> )	few
<i>Nomada flavoguttata</i>	<i>Andrena minutula</i> , <i>Andrena subopaca</i>	few
<i>Nomada goodeniana</i>	<i>Andrena nigroaenea</i> (probably others)	many
<i>Nomada leucophthalma</i>	<i>Andrena clarkella</i>	many
<i>Nomada marshamella</i>	<i>Andrena carantonica</i> (? <i>Andrena nigroaenea</i> )	few
<i>Nomada panzeri</i>	<i>Andrena fulva</i>	few
<i>Nomada ruficornis</i>	<i>Andrena haemorrhoea</i> and possibly other <i>Andrena</i> spp	few
<i>Nomada ferruginata</i>	<i>Andrena praecox</i>	one only

## Colletinae and Halictinae

*Colletes daviesanus*, *Halictus rubicundus* and *H. tumulorum* are very common medium sized dark coloured fossorial bees nesting in a variety of bank locations. The nest sites of the three *Lasioglossum* species currently appear to be on the lower parts of the bank where the slope is less severe and particles of fallen soil and sand falling from above have accumulated. These species gather pollen from a variety of sources to provision their nests.

Species	Months currently recorded with notes on some plants	abundance
<i>Colletes daviesanus</i>	June. in vertical slopes of sand pits etc -visits Asteraceae	frequent
<i>Halictus rubicundus</i>	May to September. Vertical slopes as above -many flowers	frequent
<i>Halictus tumulorum</i>	June to August. Nest in horizontal bare soil – many flowers	scarce
<i>Lasioglossum calceatum</i>	April to September. Nest in lower slopes- much not known	frequent
<i>Lasioglossum rufitarse</i>	April to May. Nest in exposed soils – visits many flowers	frequent
<i>Lasioglossum villosulum</i>	June to September. in level exposed soils – Asteraceae	frequent

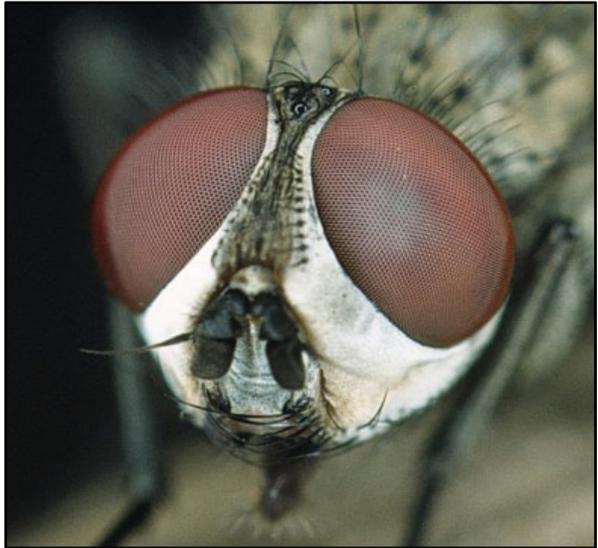
The bees just mentioned in this account are all likely to forage quite widely over the reserve. Diverse vegetation in the sheltered sunny area between this double hedgerow (below) will provide ideal conditions for this. Some show eusocial tendencies – associating together in nesting aggregations and showing developmental characteristics that might eventually lead to fully social lifestyles.



**Insects of other orders associated with solitary bees that have been discovered on the Bank.**



*Bombylius major*



*Leucophora obtusa*



*Amobia signata*



*Metopia argyrocephala*

**Satellite Flies and allied species.**

The large and handsome Bee Fly (*Bombylius major*) has been recorded on the Bank in April. The female flicks eggs into the burrows of solitary bees and emerging larvae enter cells of the hosts where they parasitise and eventually kill the host larvae. Several species of *Andrena* on the bank may be the targets (*Andrena fulva* and *A. haemorrhoea* are both likely hosts).

Flies from other families have similar habits, the three currently recorded being *Leucophora obtusa* (an anthomyid fly) which is a familiar sight as it shadows incoming aculeates about to enter nest burrows, *Amobia signata* (a sarcophagid fly) which is usually less conspicuous as it lurks around awaiting opportunities and *Metopia argyrocephala* - a small fly with similar habits - remarkable for the brilliantly shining silver areas on the head (especially in the male) which must dazzle and confuse any insect in the immediate vicinity. The Sarcophagids (or flesh flies), to which family the last two belong, have a number of representatives capable of laying eggs already in the process of becoming active larvae so host/substrate location time is much reduced.

Certain bees of the genus *Sphecodes* (red and black cleptoparasitic bees) are associated with *Lasioglossum* species. With conspicuous black and red colouration, these are readily recognised. None has so far been seen on this bee bank, but they are regularly found on older sandy sites in the Valley. Perhaps the colonisation period has been too short for them to have located hosts here.

### **Species accounts for the Solitary Wasps of the Bee Bank**

Whilst the Bank is best known for the activities of large and conspicuous bees, it is also a home to a number of different solitary wasps. These can be very common during the summer months and much needs to be discovered about their nesting habits on site. Whilst solitary bees are usually associated with collection of pollen, solitary wasps are most usually collectors of invertebrate prey. The Bank is home to species with a surprisingly different range of lifestyles.

#### **Chrysidae**

So far we have recorded a single species on the bank- *Chrysis ignita* ('Ruby-tailed Wasp'). This small but brilliantly coloured wasp is cleptoparasitic on the wall mining bee (*Ancistroceros parietum*) and probably related species. It is frequently seen exploring the bank in high summer when these black and yellow solitary wasps are starting to appear in numbers.



#### **Pompilidae**

Three different spider – hunting wasps have been noted. Two (*Anoplius nigerrimus* & *Arachnospila anceps*) are regular visitors characterised by very rapid flight patterns close to the ground as they search for spider inhabitants of the bank. The third (*Priocnemis perturbator*) is one of Britain's largest and most spectacular insects and operates in late spring when it targets some of the larger spider species. The wasps of this family paralyse their hosts and drag them into prepared burrows in sandy areas such as the bank. An egg is laid on the prey and develops at the expense of the host. Andy Purcell (SANDNATS) has made a photographic study of this wasp in action and one of the pictures from his sequence is shown on page 9.



*Prioctenemis perturbator*



*Odynerus spinipes*

### Eumininae

There are four members of the potter wasp family on the bank. *Ancistrocerus gazella* and *Ancistrocerus trifasciatus* are frequently encountered species in the Valley but *Ancistrocerus parietum* ( the Wall Mason Wasp) is probably the one most likely to be seen when numbers emerge in high summer.. These three species usually stock nest burrows with small caterpillars, upon which they lay their eggs.

*Odynerus spinipes* (the Spiny Mason Wasp -pictured above right) is currently poorly known in Birmingham and the Black Country. It nests in vertical banks and constructs elaborate tubes of sand and soil particles over the openings and targets weevil species of the genus *Hypera*. The burrow is provisioned with these and the eggs of the wasp are placed by them. All these potter wasps will visit flowers for nectar.

### Sphecidae

Eleven different Sphecid wasps are recorded from the bank. These insects have interestingly diverse life histories. They visit a wide variety of flowers to take nectar, but their nesting strategies are varied and a wide range of prey species are collected by females for provisioning the nests. Size difference is also considerable. The largest RSPB species is 15 mm in length, the smallest some 3mm. Various nesting cavities are also used. One of the most striking is that of the Slender Wood Borer Wasp (*Trypoxylon attenuatum*). In managing the Bee Bank, volunteers are encouraged to cut back plants such as Bramble regularly until only a few cm of stem is left. These cut stems are often colonised as they die and harden. The Slender Wood Borer Wasp soon takes up residence and currently in August, a number can be seen emerging from central stem cavities to forage for spiders on warmer days. The table beneath provides some ecological notes.

Species	Months	Notes
<i>Trypoxylon attenuatum</i>	May to August	frequent- several seen. In cut stems- prey small spiders
<i>Crossocerus elongatulus</i>	June	frequent- several seen –in sandy banks –prey small flies
<i>Crossocerus ovalis</i>	May to August	frequent –several seen
<i>Crossocerus varus</i>	August	single record- small species preying on small flies
<i>Crossocerus megacephalus</i>	May	single record –dead woody material –prey small flies
<i>Crossocerus 4-maculatus</i>	August	single record- sandy ground – prey small flies, caddis & moths
<i>Lindenius albilabris</i>	June	single record- bare ground- prey small homopteran bugs & flies
<i>Rhopalum coarctatum</i>	September	single record –hollow plant stems- prey small flies
<i>Entomognathus brevis</i>	August	single record- sandy slopes- prey small leaf beetles
<i>Passaloecus singularis</i>	June to July	frequent – several seen- pithy stems- prey wingless aphids
<i>Nyssus trimaculatus</i>	August	one record- cleptoparasite of <i>Gorytes</i> sp (not yet found in SV)

## Species quality in a local and national context

Conservationists are frequently interested in the significance of insect assemblages such as this. They wish to know if they are common to many sites or have local, regional or national significance. Archer and Burn (1995) introduced a new national quality scoring system. This scored a sizeable set of target species based on a number of criteria (such as the quantity of individual species records appearing in national databases and geographic distribution).

The table below enables readers to see the system and the scores allocated to 51 qualifying aculeates on the RSPB reserve. A number of social bees and wasps do not qualify for consideration.

STATUS	STATUS SCORE (A)	No. SPECIES (B)	QUALITY SCORE (A X B)
Universal	1	35	35
Widespread	2	14	28
Restricted	4	1	4
Scarce	8		
Rare	16	1	16
Very rare	32		
TOTAL		51	83

The Species Quality Score (SQS) for the RSPB aculeates is  $83/51 = 1.6$

In the context of some Staffordshire scores, this does not make the site particularly significant nationally or regionally. As one might expect the more common species dominate. As can be seen, so far the RSPB site has only a single species classified as rare (*Nomada ferruginea*). An example of an important West Midland site near Birmingham, is Hartlebury Common (Worcs) with a score of 3.4 (Archer 2004).

Not all workers make use of Archer scores. Sometimes the presence on site of sufficient high quality species using the current national ratings (Nationally Scarce etc) can be used. The number of scarce solitary bees and wasps discovered at Highgate Common (Jukes 2004) was a significant factor in its designation as a Site of Special Scientific Interest.

So what of the status of the RSPB reserve with regard to its bees and wasps ? It is most certainly a most interesting site with a substantial dataset and is subject to continuing survey attention. It certainly deserves to be considered as being a site of Local Importance for Aculeates.

### Parasitism and Cleptoparasitism

This topic has already been partially covered at an earlier stage of the report when various species were cited as having an influential part to play in the lives of solitary bees on the bank. This phenomenon is universally present in these situations. The **cleptoparasitic load** is the percentage of aculeate species that are cleptoparasites (or parasitoids) on other host aculeates. Some equilibrium must be reached as colonisation evolves but also as a consequence of wider considerations (Weislo 1987 in Archer 2004). This topic is not visited at the current stage of colony evolution.

## Discussion

Some 46 different species of solitary wasp have been recorded on the Bank during the 10 years since its construction. The precise history of colonisation cannot be reliably revealed by this study but it is likely that a multiplicity of factors affect the establishment of populations here. The majority of the species are strictly fossorial.

### Area limitation.

The bank area is not large. This may limit to its hosting capacity for bee and wasp species.

### Natural erosion.

The bank is very open to the elements and these have resulted in a steady retreat of the original bank. Evidence of this can be seen in the undercutting of larger stones in the surface & the steady accumulation of light sand at the foot of the exposure.

### Erosion caused by the tunnelling activity of the bees wasps and ants.

This is a significant factor as anyone who has observed the bank on an active day in spring can testify.

### **Management Practice and visitor pressure**

These are major factors. Physical removal by cutting back of invasive vegetation is necessary for amenity purposes (visiting the hide and viewing the Bank for educational reasons). It is also necessary so the basic integrity of the Bank is retained. Aculeates need the retention of bare earth / sand surfaces and the footfall of children curious to watch the show can actually be beneficial at the lower fringes, because certain species like hard compressed soil.

### **Inter and intraspecific competition.**

There is some evidence that the species composition on the Bank varies. Potential colonists may be unable to retain a foothold for a number of reasons – significant ones probably being dominance of certain resident insects by virtue of size or aggression, and factors such as tunnel density on the bank. There is already evidence that a species has had but a temporary residence on the bank - the Spiny Mason Wasp having failed to appear since 2011 – the last occasion when the conspicuous mud nest tubes were seen.

Multi occupancy of tunnels is also a likely scenario on site and whilst many species seal or cover brood chambers, there is likely to be a good deal of ‘tomb raiding’ or collateral damage caused by any invertebrates engaged in secondary use of tunnels. The Bank is an excellent site for further investigations of these phenomena. Much remains to be discovered.

At first sight there may appear to be a remarkable degree of species tolerance on a bank with over 40 resident species, but a glance at emergence data will suggest that in fact the number of species active on any one day or over a period of several days is limited. On May 20<sup>th</sup> 2011, 8 different adult aculeate species were recorded as active on the bank and this count, though equalled, was not exceeded at any time. Different species have different phenology (period of adult seasonal appearance) and therefore many species never actually come into contact with each other at all. Whilst this may give a colonising species the opportunity to found a colony without too much conflict with others, its actual long term survival on the bank and the nature of its establishment there obviously depends upon a variety of factors.

### **Predation by other invertebrates on the Bank**

The presence of spiders has been mentioned. There is certainly a good population of these, but many appear to be small and active bee and wasp tunnels are not attractive options for them! Spiders certainly take over old tunnels and copious webs are apparent in the fringe vegetation. Examination of webs (inasmuch as this has been done) has not revealed recognisable aculeate debris. *Trypoxylon attenuatum* has been previously mentioned as a predator of small spiders. The regular activity of the Pompilid wasps may also act as a limiting factor on population growth of many smaller and some larger spiders (which additionally feature in the diet of a number of birds). So whilst some spiders undoubtedly do take bees and wasps, their own situation is always a precarious one on exposed habitats such as this. .

### **Threats from other invertebrate species from elsewhere on the reserve**

Predation by other specialised aculeates with colonies elsewhere is certainly likely to take place. The Reserve is home to over 60 recorded bees wasps and ants. One of these - the large Sphecid wasp *Cerceris rybyensis* (recorded from the hide pathway and in the wildlife garden near the new centre building) is a known predator of a variety of solitary bees, *Halictus* species being favoured prey items. Dragonflies may well also be predators although there is no current evidence as to the extent of this.

### **The impact of vertebrate predators**

Research appears to indicate that bees are not generally attractive to most birds. The tough integument and other factors may be a deterrent (Mostler 1935). On the other hand, what looked like a mouse burrow was noted at the North end of the bank in 2015. Mechanical damage by ground dwelling mammals is always a possibility.

### **The significance of the Bee Bank in a local and wider context.**

Studies of this kind have been carried out on a number of wildlife sites in the British Isles. Most have taken place in well studied areas of known conservation interest. Currently the bank only hosts a single rare species of nomad bee so its central points of interest do not revolve around scarce insects but lie rather in investigation of the complex invertebrate ecology that has unfolded. A significant feature is the large number of species that have been discovered from an area of under 30 square metres. The Bank seems to have been a magnet to them. It is likely to remain a valuable thermometer of local aculeate activity.

### **Conclusions**

Bare earth habitat is extremely uncommon in the Sandwell Valley and in recognising the importance of the Bee Bank as providing a home for this specialised assemblage of insects, the RSPB is greatly to be commended.

It is likely that most of the Bee Bank aculeate species are dedicated to that site. The majority have been captured when entering nest holes or patrolling /resting on site for prolonged periods. There are few ‘tourists’ (just visiting).

A dynamic and complex set of interrelationships prevails during the process of Bank colonisation. This will continue to be the case. Other families of insects also have a stake in this and their representatives on the Bank and from elsewhere are certainly influential in the lives of the main aculeate players.

It is not only the Honey Bee (also plentiful on the Reserve) that acts as a pollinator of its flowers. These solitary bees and wasps also play valuable roles in this.

The work done here provides a useful basic list of solitary bee and wasp species recorded on the Bee Bank and on the Reserve at large. Whilst the data here may be of initial interest, future studies will only be rewarded by continuing intensive observation and closely focussed hard work. The Bank is ideally situated for a student to undertake work with the potential to make a valuable contribution to British aculeate research literature.

Although the study has so far failed to detect a significant group of scarce or rare species, for a variety of other reasons discussed here, the RSPB Reserve may certainly be considered as a site of Local Importance for Aculeates.

## Acknowledgements

I would like to thank the Wardens and Site Managers (past and present) of Sandwell RSPB for permitting this survey to take place and also the volunteers for their active cooperation in the evolution of the Bee Bank. Special mention has to be made of Mike West (RSPB) for regular involvement, Andy Purcell for his high quality photography and Steven Falk for checking the identity of *Nomada ferruginea* - currently the rarest species discovered during the survey. Additional thanks are given both to Steven and Dr Mike Archer for checking many aculeate specimens in my collection during past years, and thus ensuring that I have a useful set of reference species to help in identification of this 'difficult' group of insects.

Finally I would like to thank Sara Carvalho of 'EcoRecord' (the Wildlife Trust for Birmingham and the Black Country) for permitting me to have continuing access to relevant records. Peter Shirley has also commented on the report and corrected some errors.

## Systematic list of species recorded

Species in bold were found on the bank and are believed to have nests there. The other species were found in a number of locations on the Reserve.

### Bethylidae

*Bethylus fuscicornis* (Jurine) (current location on the Reserve not exactly known).

### Chrysididae (ruby –tailed wasps)

***Chrysis ignita*** (Linnaeus)

### Pompilidae (Spider- hunting wasps)

***Priocnemis perturbator*** (Harris, 1780)

***Arachnospila anceps*** (Wesmael, 1851)

***Anoplius nigerrimus*** (Scopoli)

### Eumeninae (Potter or Mason wasps)

***Ancistrocerus gazella*** (Panzer)

***Ancistrocerus parietum*** (Linnaeus)

***Ancistrocerus trifasciatus*** (Muller 1776)

***Odynerus spinipes*** (L.)

Vespinae (Social wasps)

*Paravespula vulgaris* (L)

Sphecidae (Solitary wasps)

*Trypoxylon attenuatum* (Smith F.), *Crossocerus elongatulus* (Vander Linden),  
*Crossocerus ovalis* (Lepeletier & Brulle), *Crossocerus varus* (Lepeletier & Brulle),  
*Crossocerus megacephalus* (Rossius), *Crossocerus quadrimaculatus* (Fabricius)  
*Lindenius albilabris* (Fabricius), *Entomognathus brevis* (Vander Linden)  
*Rhopalum coarctatum* (Scopoli), *Passaloecus singularis* (Dahlbom)  
*Nysson trimaculatus* (Rossius), *Cerceris rybyensis* (Linnaeus)

Colletinae (Solitary bees)

*Colletes daviesanus* Smith F.

Andreninae (Solitary fossorial bees)

*Andrena bicolor* (Fabricius), *Andrena clarkella* (Kirby), *Andrena caratonica (=scotica)* (Perez)  
*Andrena cineraria* (Linnaeus), *Andrena fulva* (Muller), *Andrena haemorrhoea* (Fabricius),  
*Andrena minutula* (Kirby), *Andrena nigroaenea* (Kirby), *Andrena nitida* (Olivier),  
*Andrena Praecox* (Scopoli) by association. *Andrena semilaevis* (Perez)  
and *Andrena subopaca* (Nylander).

Halictinae (Solitary bees)

*Halictus rubicundus* (Christ), *Halictus tumulorum* (Linnaeus), *Lasioglossum albipes* (Fabricius),  
*Lasioglossum calceatum* (Scopoli), *Lasioglossum leucopum* (Kirby). *Lasioglossum rufitarse*  
(Zetterstedt), *Lasioglossum villosulum* (Kirby,

Megachilinae (Leaf-cutter bees)

*Megachile willughbiella* (Kirby), *Megachile versicolor* (Smith)

Anthophorinae (Cleptoparasitic solitary bees and flower bees)

*Nomada fabriciana* (Linnaeus), *Nomada ferruginata* (L.), *Nomada flava* (Panzer),  
*Nomada flavoguttata* (Kirby), *Nomada goodeniana* (Kirby), *Nomada leucophthalma* (Kirby),  
*Nomada marshamella* (Kirby), *Nomada panzeri* (Lepeletier), *Nomada ruficornis* (Linnaeus).  
*Anthophora plumipes* (Pallas)

Apinae (Social bees)

*Bombus hortorum* (Linnaeus), *Bombus lapidarius* (Linnaeus), *Bombus lucorum* (Linnaeus),  
*Bombus pascuorum* (Scopoli), *Bombus pratorum* (Linnaeus), *Bombus terrestris* (Linnaeus).  
*Apis mellifera* (L),

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## Additional general reading on surveys of sites in and around Birmingham:

Bloxham, M.G. 2008. **The Biodiversity Audit of Birmingham Eastside (2004-2008): The ants, bees and wasps (Hymenoptera: Aculeata)**. Proc. B'ham. Nat. Hist Soc. Vol 28 Number 4. 203- 234.

Falk, S.J., Lane. S., Slawson, C. and Bloxham. M.G. (1996). **A comparative Study of the Invertebrate Assemblages of Three Staffordshire Heathland Sites**. 138 pp. National Lowland Heathland Programme. Published by the Staffordshire & West Midlands Heathland Partnership

General survey data can be found in the entomological logs of M. Bloxham (2000 to 2015). These have mostly been converted to electronic records.

## Websites

The website of the Bees, Wasps and Ants Recording Society <http://www.bwars.com/> has been a valuable point of reference at regular intervals during the course of the survey,

Another very useful web resource for anyone wanting good pictures of the insects named here is [www.flickr.com](http://www.flickr.com). If the scientific names are copied to the browser, a series of photos of the bee or wasp taken by Steven Falk can readily be found.

M.G. Bloxham. September 2015.