April-June 2003

Number 1045
Volume 128

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Published by the Yorkshire Naturalists' Union

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THE WASPS AND BEES (*HYMENOPTERA: ACULEATA*) OF REMNANT SITES IN INTENSIVE AGRICULTURAL COUNTRYSIDE IN WATSONIAN YORKSHIRE: BRAYTON BARFF, RINGHAY WOOD, SOUTH CLIFFE COMMON AND THORNTON ELLERS

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Lowland landscapes in Britain are highly fragmented and semi-natural habitat, which often survive as isolated patches embedded in intensive farmland (Fuller 1999). Such isolated fragments can have interesting assemblages of aculeate wasps and bees. This paper considers four such sites.

Brayton Barff (SE5830) (Selby district of North Yorkshire county), in the Humberhead Levels natural area, is situated next to the village of Thorpe Willoughby, *c*.4 km west of Selby. The site, of *c*.30.6 ha, is an isolated hill covered by open deciduous woodland. The open areas include a sand pit and flower-rich grassland. Bramble is extensive between the mainly oak woodland and the open grassy areas.

Ringhay Wood (SE4535) with the grounds of Lotherton Hall (Leeds Unitary Authority) (*c*.20 ha) is situated in the Southern Magnesium Limestone natural area. It is *c*.1.5 km south-east of Aberford and *c*.8.5 km south-west of Tadcaster. The grounds of Lotherton Hall consist of open woodland, shrubs, herb-rich meadow and gardens with old brick walls. Dead wood in sunny situations, which was used by aerial nesting aculeates, has now mostly been removed. Ringhay Wood is open calcareous woodland. The open areas are herb-rich with dead wood which is becoming covered by plant growth and bare flat and sloping ground used by subterranean nesting aculeates.

South Cliffe Common (SE8635) (East Riding of Yorkshire Unitary Authority) is situated in the Humberhead Levels natural area, *c*.6 km north-west of North Cave and *c*.6 km south-west of Market Weighton. The site, of *c*.41 ha, is mainly sandy lowland heathland, acid dry grassland, deciduous woodland and bare sandy flat areas with slopes and vertical banks. The site is a very small remnant of a once much more extensive series of sandy habitats.

Thornton Ellers (SE7245) (East Riding of Yorkshire Unitary Authority) is situated in the Vale of York and Mowbray natural area, *c*.5 km south of Wilberfoss and c.8 km south-west of Pocklington. The very small sandy site, of *c*.4 ha, consists of open woodland, shrubs (particularly gorse), dry acid grassland and bare sandy areas including a pit with a pond. Bare flat areas and sloping and vertical banks are plentiful, providing nesting sites for subterranean aculeates.

Methods

Between 1996 and 2001, 19 visits were made to Brayton Barff, distributed throughout the year as follows: April (2 visits), May (4), June (4), July (4), August (4), September (1). In addition W. J. Fordham visited the site on 12 Aug. 1917 finding two species identified by C. Morley, P. Kendall visited three times (6 Aug. 1981, 31 Aug. 1983, 5 May 1992) finding four species identified by the author, and A. Godfrey visited on 19 July 2000 finding one species identified by himself.

Between 1992 and 2000, 17 visits were made to Ringhay Wood and Lotherton Hall, distributed throughout the year as follows: April (2), May (3), June (4), July (4), August (3), September (1).

Between 1988 and 1996, 15 visits were made to South Cliffe Common, distributed throughout the year as follows: April (1), May (3), June (3), July (4), August (3), September (1).

Between 1991 and 1998, 14 visits were made to Thornton Ellers, distributed throughout the year as follows: April (1), May (3), June (3), July (3), August (3), September (1). In

addition M. L. Denton visited the site on 24 June 1989 finding one species identified by the author.

During my visits, which lasted for approximately two to three hours, all species of aculeate wasps and bees were recorded (Archer sample) and usually collected with a hand net for identification.

In the following account, the nomenclature can be related to that of Kloet and Hincks (1978). An up-to-date checklist can be found on the Bees, Wasps and Ants Recording Society (BWARS) web pages at http://www.bwars.com.

Species Present and Seasonal progression of Species

A full list of recorded species is given in the Appendix. At the family level, Tables 1 and 2 show the taxonomic distribution of species and records. A record represents a specimen differing in one of the following three variables: name, sex and day of visit. The solitary wasp family, Sphecidae, and the solitary bee subfamilies, Andreninae and Halictinae, are the dominant taxa in terms of the number of species and records, although the bee subfamily, Anthophorinae, is also important. South Cliffe Common and Thornton Ellers provided, on average, more solitary species per visit than Brayton Barff and Ringhay Wood with Lotherton Hall.

Table 3 shows the number of species and when species were first recorded for each month. The most productive month for the solitary wasp species for all four sites was July. Most species of solitary wasps were first recorded during June or July. Since June and July are summer months, most solitary wasp species would seem to have to wait until the warmer summer months before the adults can become active. The most numerous solitary wasp species recorded were: from Brayton Barff – *Crabro peltarius*, a subterranean nester found in a large aggregation in the sand pit, and the subterranean nesters *Crossocerus ovalis* and *Oxybelus uniglumis*; from Ringhay Wood with Lotherton Hall – the subterranean nester *Crossocerus elongatulus*, the parasite, *Chrysis ignita*, and the aerial nesters *Ectemnius cavifrons* and *E. cephalotes* whose workings in dead wood are made evident by the presence of wood shavings; from South Cliffe Common – the subterranean nesters *Oxybelus uniglumis*, *Mellinus arvensis*, *Arachnospila spissa* and *Crossocerus quadrimaculatus*; and from Thornton Ellers – the subterranean nesters *Oxybelus uniglumis* and *Crossocerus quadrimaculatus*, the cleptoparasite *Evagetes crassicornis* and the aerial nester *Ancistrocerus trifasciatus*. The wingless female parasite, *Myrmosa atra*, was found with its host *Oxybelus uniglumis* at Brayton Barff, South Cliffe Common and Thornton Ellers. The host of *Chrysis ignita* could have been *Ancistrocerus trifasciatus*, although the association between these two species has not been firmly established. *Chrysis impressa* has been found to be the parasite of *Ancistrocerus trifasciatus* and both these species were found at Thornton Ellers. The host of *Evagetes crassicornis* at Thornton Ellers was probably the recorded *Arachnospila anceps*. The female of *E. crassicornis* enters the cell of its host, eats the host's egg and substitutes its own.

The most productive month for solitary bee species was May, although sometimes June was nearly as important. May was also the most productive month for the first recording of species. Thus, in contrast to the solitary wasps the solitary bees species are mainly restricted to the late spring, although some species are found during the spring and summer, e.g. species of *Halictus*, *Lasioglossum* and *Sphecodes*, and some species are restricted to the summer, e.g. *Colletes succinctus* with its cleptoparasite *Epeolus cruciger, Andrena fuscipes* with its cleptoparasite *Nomada rufipes* and *Anthophora furcata*. The most numerous solitary bee species recorded from Brayton Barff were *Lasioglossum leucozonium, Andrena cineraria, A. wilkella* and *A. haemorrhoa*; from Ringhay Wood with Lotherton Hall *Halictus tumulorum*, *Andrena chrysosceles* and *Lasioglossum smeathamellum*; from South Cliffe Common *Andrena barbilabris* with its cleptoparasite *Sphecodes pellucidus, Colletes succinctus* and *Lasioglossum rufitarse*; and from Thornton Ellers *Lasioglossum villosulum* with its cleptoparasite *Sphecodes geoffrellus* and the cleptoparasite *S. monilicornis* whose hosts were probably the recorded *Halictus rubicundus*

TABLE 1
The number of species of aculeate wasps and bees recorded from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	Brayton	Ringhay	South Cliffe	Thornton
Solitary wasps				
Chrysididae	2	4	4	6
Mutillidae	1	0	1	1
Pompilidae	3	3	8	8
Eumeninae	4	1	1	3
Sphecidae	23	16	25	23
Total solitary wasps	33	24	39	41
Solitary bees				
Colletinae	2	1	2	2
Andreninae	13	10	9	8
Halictinae	13	10	8	11
Megachilinae	4	3	1	3
Anthophorinae	7	8	6	6
Total solitary bee	39	32	26	30
Total solitary species	72	56	65	71
Social wasps and bees				
Vespinae	4	6	5	4
Apinae	11	10	9	8
Total social species	15	16	14	12
Total wasps and bees	87	72	79	83

TABLE 2
The number of records of solitary wasps and bees in the Archer sample from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	Brayton	Ringhay	South Cliffe	Thornton
Solitary wasps				
Chrysididae	3	11	12	12
Mutillidae	2	0	1	2
Pompilidae	3	3	20	25
Eumeninae	6	3	3	9
Sphecidae	77	41	83	62
Total solitary waps	91	58	119	110
Solitary bees				
Colletinae	3	3	8	5
Andreninae	47	49	27	23
Halictinae	41	38	28	44
Megachilinae	7	6	1	4
Anthophorinae	14	16	13	21
Total solitary bee	112	112	77	97
Total solitary species	203	170	196	207
No. records per visit	10.7	10.0	13.1	14.8

TABLE 3
The number of species, and when species were first recorded, per month of solitary species at Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers (Archer sample).

	Apr	May	Jun	Jul	Aug	Sep
No. species – Wasps						
Brayton	0	1	14	21	13	3
Ringhay	0	5	11	16	9	0
South Cliffe	0	9	16	31	13	2
Thornton	0	3	19	26	14	5
No. species – Bees						
Brayton	9	18	17	12	10	4
Ringhay	7	21	17	13	6	2
South Cliffe	3	17	7	10	7	3
Thornton	3	23	12	11	5	2
No. species first recorded – Wasps						
Brayton	0	1	13	12	5	1
Ringhay	0	5	7	10	2	0
South Cliffe	0	9	9	17	4	0
Thornton	0	3	18	15	5	0
No. species first recorded – Bees						
Brayton	9	13	10	4	3	0
Ringhay	7	14	6	3	2	0
South Cliffe	3	14	1	8	0	0
Thornton	3	21	1	5	0	0

and *Lasioglossum calceatum*. All these bee species are subterranean nesters or cleptoparasites of subterranean nesters. The cleptoparasites of *Andrena haemorrhoa* and *Halictus tumulorum* were not recorded, perhaps indicating that these cleptoparasites have become extinct, because their populations have become too small to support them on the isolated sites.

Estimating the potential number of Solitary Wasp and Bee Species

To determine whether to stop recording from a site it is necessary to estimate the potential number of species that might be found there. Normally to use such statistical procedures it has been necessary not only to know the species found on a visit but also the number of individuals of each species. The data collected by the author was only on the species present on a visit. Recently non-parametric statistical procedures have become available to estimate the potential number of species on a site when only presence data are available. The statistical procedures used are the presence/absence Chao (in Colwell & Coddington 1944) and jackknife (Heltshe & Forrester 1983) estimators, using the software of Pisces Conservation Ltd. The Chao estimate depends on the number of species found and the number of species found on one (unique species) and two (duo species) visits or samples. The jackknife estimate also depends on the number of species found and the number of unique species. The statistical procedures are run a number of times equal to the number of samples or visits. In practice the software selects 1, 2, etc. samples at random each time calculating a mean estimate of species richness. With a small number of samples the estimates are erratic, but as larger sample sizes are selected the estimates may stabilize giving confidence in them. The Chao and jackknife estimates with increasing sample size from the largest number of samples are shown in Table 4.

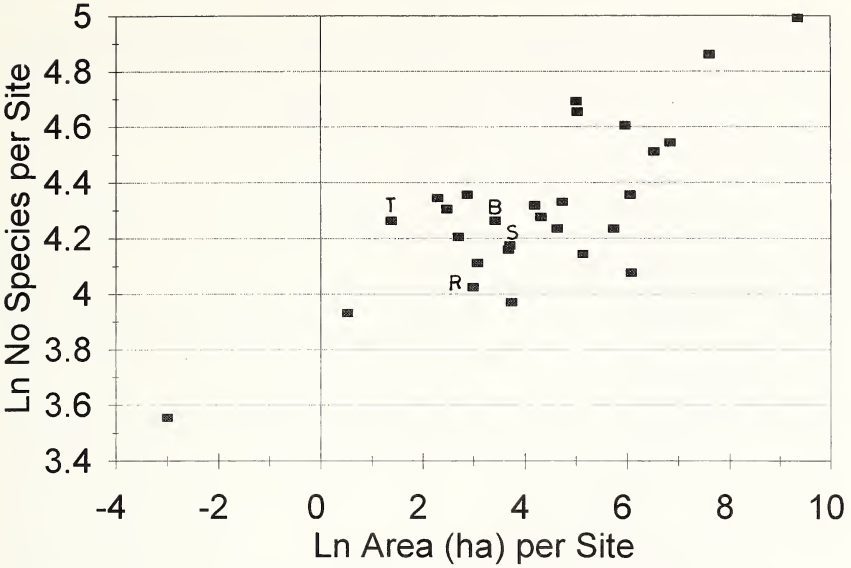

FIGURE 1.
Species-area plot for sites from the north and north Midlands of England.
(B = Brayton Barff, R = Ringhay Wood with Lotherton Hall, S = South Cliffe Common, T = Thornton Ellers).

For all four sites the Chao and jackknife estimates stabilize so giving confidence in them. The Chao and jackknife estimates for each site are very similar to each other, except possibly Thornton Ellers. It can be calculated that over 70% of the potential number of species have been recorded, which, as a rough measure, can be considered as the stopping point for recording from a site.

It is assumed that the estimates are of the number of species resident on a site, but could include vagrant and tourist species. Vagrant species are species found well outside their normal geographical distribution and tourist species are species that do not nest on, or regularly use, the study site for food or other resources. Vagrant and tourist species, if recorded as unique species could lead to an inability to stabilize the estimates. Archer (2000a, 2000b) found that at Hartlebury Common in Worcestershire the estimates only stabilized after the tourist species had been excluded from the estimating procedures. However, even if the estimates stabilize, the estimates may represent resident and tourist species since with increasing sample size even the tourist species may cease to be unique. No vagrant species were found at the four sites but it is more difficult to determine if any tourist species were present.

What is the Natural History or Conservation Value of Each Site

At a national level (Shirt 1987, Falk 1991) Brayton Barff has a scarce species (Na) *Nomada integra* (= *N. pleurosticta*), South Cliffe Common has a scarce species (Nb) *Priocnemis schioedtei* and Thornton Ellers has two Red Data Book species (*Andrena ruficrus* and *Nomada lathburiana*) and a scarce species (Nb) *Nysson trimaculatus*. Recent investigations by BWARS (Archer 2002c) indicate that *P. schioedtei*, *N. lathburiana* and *N. trimaculatus* should be downgraded and lose their national status. Again, recent

TABLE 4
Non-parametric estimates of species richness of solitary species at Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers (Archer sample)

	Chao estimate	Jackknife estimate.
Brayton Barff		
No. species – recorded	71	71
– estimated	99	99
95% confidence limits	76-122	86-112
% of estimated spp. found	72	72
Ringhay Wood with Lotherton Hall		
No. species – recorded	56	56
– estimated	76	76
95% confidence limits	56-96	66-86
% of estimated spp. found	74	74
South Cliffe Common		
No. species – recorded	65	65
– estimated	86	87
95% confidence limits	66-105	77-98
% of estimated spp. found	76	75
Thornton Ellers		
No. species – recorded	71	71
– estimated	86	95
95% confidence limits	72-101	79-112
% of estimated spp. found	83	75

investigations by BWARS (Archer 2002c) indicate the following species should be upgraded in importance at the national level: from Brayton Barff *Chrysis viridula*, from South Cliffe Common *Diodontus tristis* and *Ectemnius dives* and from Thornton Ellers *Diodontus tristis*. In summary all the sites, except Ringhay Wood with Lotherton Hall, have recorded species of national importance, and especially noteworthy the presence of *Andrena ruficrus* at Thornton Ellers.

With the help of latest information from BWARS, all species may be given a national status score (Archer 2002c) depending on their rarity and distribution. The definitions of the six statuses used are given in Archer (1999, 2002c). Adding the status scores for each species from a site gives a national Quality Score, while dividing the Quality Score by the number of species found on a site gives the national Species Quality Score (SQS) (Table 5). Although quality scores are greatly influenced by the areas of sites, the SQSs are relatively independent of site area (Archer 1999) and can be used to compare different Yorkshire sites.

SQSs have been determined for 23 Yorkshire sites and range from 1.2 to 2.9. These sites can be divided into three groups depending on their SQSs as follows: first class 2.4-2.9 (e.g. Crow Wood), second class 1.8-2.3 (e.g. Strensall Common, Duncombe Park) and third class 1.2-1.7 (e.g. Cave Wold, Seckar Moor). Using SQSs from Table 5 all the current study sites are third class except for Thornton Ellers which is a second class site. Therefore, it is likely that the isolation of these sites has resulted in their lower SQSs. Other Yorkshire third class sites, e.g. Burton Leonard Lime Quarries, Holmehouse Wood near Keighley, Seckar Moor and Rossington Bridge, could also be considered as isolated sites.

In a Yorkshire context, using the number of species recorded from a site can be used as a crude measure of the quality of a site (Archer 2002c). Brayton Barff is a very good site and Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers are good sites. Furthermore, the following species are considered rare in Yorkshire (Archer 2002c):

TABLE 5

The Archer national quality scores of the solitary species recorded at Brayton Barff (B), Ringhay Wood with Lotherton Hall (R), South Cliffe Common (S) and Thornton Ellers (T).

National status	Status values (A)	No. species (B)				Quality scores (A x B)			
		B	R	S	T	B	R	S	T
Universal	1	46	37	46	48	46	37	46	48
Widespread	2	24	19	17	21	48	38	34	42
Restricted	4	0	0	0	0	0	0	0	0
Scarce	8	1	0	2	1	8	0	16	8
Rare	16	1	0	0	0	16	0	0	0
Very rare	32	0	0	0	1	0	0	0	32
Total (Quality Score)		72	56	65	71	118	75	96	130
Species Quality Score (Quality Score/B)						1.6	1.3	1.5	1.8

from Brayton Barff *Vespa crabro* and *Bombus rupestris* and from South Cliffe Common *Mimesa lutaria*. The discovery of *B. rupestris* is particularly significant as previously it was considered extinct in Yorkshire.

Comparisons with Other Sites

Since the species diversity investigations have shown stable estimates for the four sites sufficient species have been recorded from each site to carry out comparisons with other sites. These will be made with respect to the areas of the sites, cleptoparasitic loads and aerial nester frequencies.

Species-area Relationships

The number of solitary species can be related to site area. The areas of Brayton Barff and Thornton Ellers are clearly defined on maps while the study area of South Cliffe Common can be readily determined. The study area of Ringhay Wood with Lotherton Hall is more difficult to determine since it was mainly based on a series of pathways and parts of the grounds of Lotherton Hall.

The species-area relationship can be found by plotting the number of solitary species recorded at a site against the area of the site, with both the number and area expressed as natural logarithms (ln). Figure 1 shows a species-area plot for 28 sites from the north and north Midlands of England including the current study sites. The correlation coefficient of 0.786 is highly statistically significant ($p<0.001$) indicating a positive linear relationship between numbers of species and areas of sites. The coefficient of determination indicates that 61.8% of the variation of the number of species between sites can be explained by the variation in areas of sites. The regression equation for the relationship is: ln number of species = 3.90 + 0.097 x ln area (ha), which is similar to that given in Archer (2001) based on 18 sites.

Since the dots for the four current sites fall within the dots of the other sites (Fig. 1) the isolation of these sites has not prevented them from retaining the number of species that might be expected for their areas.

Cleptoparasitic Load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasitic (or parasitoids) on other host aculeates. Wcislo (1987) showed that parasite behaviour among aculeate Hymenoptera correlated with geographical latitude. Thus the parasitic rates are higher in temperate regions, as host populations are more synchronised in their life-history characteristics than in tropical regions. This finding probably does not hold for desert regions where the occurrence of rainfall would tend to synchronise life history

characteristics. From a review of the literature Wcislo found that the CLs for bees in Europe varied between 16% and 33%, a range of 17%.

For 24 sites from north and north Midlands, the author found that CLs for solitary bees vary from 22.5% to 36.6% except for Duncombe Park, with a value of 14.1%. The low CL for Duncombe Park of 17.2% is due to the loss of *Sphecodes* cleptoparasites from this site. From Table 7, the CLs for Brayton Barff, Ringhay Wood with Lotherton Hall and South Cliffe Common fall within this range, while the CL for Thornton Ellers extends the upper limit to 40.0% giving a new range of 17.5%, which is very similar to the range found by Wcislo.

Wcislo gave no CLs for solitary wasps but from 24 sites from north and north Midlands of England CLs vary from 10.3% to 20.5%, a range of only 10.2%. From Table 6, the CLs for Brayton Barff, Ringhay Wood with Lotherton Hall and South Cliffe Common fall within this range, while the CL for Thornton Ellers extends the upper limit to 24.4% giving a range of 14.1%.

TABLE 6
The relative frequency of the cleptoparasitic (or parasitoid) species among the solitary species recorded from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic load CL = 100 x C/(H+C)
Solitary wasps			
Brayton	28	5	15.2
Ringhay	20	4	16.7
South Cliffe	33	6	15.4
Thornton	31	10	24.4
Solitary bees			
Brayton	26	13	33.3
Ringhay	24	8	25.0
South Cliffe	17	9	34.6
Thornton	18	12	40.0

Aerial Nester Frequency

The aerial-nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters mainly use old beetle burrows in dead wood and central stem cavities such as dead bramble. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered. The AFs for the study sites are given in Table 7. The AFs for solitary wasps from 17 sites in Watsonian Yorkshire vary from 0.05 to 84.4% and for the British species is 46.2%. The AFs for Brayton Barff and Thornton Ellers are very near the British AF indicating the sites have a range of both aerial and subterranean nesting sites. The very high AF for Ringhay Wood with Lotherton Hall is due to the crevices in old walls within the gardens of Lotherton Hall and dead wood in sunny situations both in the gardens and in the open areas of the wood, besides the apparent lack of suitable subterranean nesting sites. Compared with the British AF the slightly lower AF for South Cliffe Common is mainly a consequence of the readily available subterranean nesting sites in the sandy banks of the drainage ditches and streams and in the numerous open sandy areas.

The AFs for the solitary bees from 17 sites in Watsonian Yorkshire vary from 7.1% to 30.0% and for the British species is 17.9%. The AFs for Brayton Barff, Ringhay Wood with Lotherton Hall and Thornton Ellers are near the British AF, while the AF for South Cliffe Common is lower. Unlike the solitary wasps, the solitary bees of Ringhay Wood are able to use the dry calcareous clayey bare slopes and flat ground for nesting. The reason for the

lower AF for South Cliffe Common is because of the readily available nest sites, as for the solitary wasps.

TABLE 7
The nesting habits of the solitary species recorded from Brayton Barff, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers.

	No. aerial nesters (A)	No. subterranean nesters (S)	Aerial nester frequency AF = 100 x A/(A+S)
Solitary wasps			
Brayton	12	16	42.9
Ringhay	18	2	90.0
South Cliffe	10	23	30.3
Thornton	12	19	38.7
Solitary bees			
Brayton	5	21	19.2
Ringhay	5	19	20.8
South Cliffe	2	15	11.8
Thornton	4	14	22.2

Conclusions

1. In terms of the number of species, Ringhay Wood with Lotherton Hall, South Cliffe Common and Thornton Ellers are good sites, and Brayton Barff is a very good site.
2. Estimates of the potential number of solitary species present on the four sites are stable and, therefore, it can be calculated that over 70% of the species on each site have been recorded.
3. All the sites, except for Ringhay Wood with Lotherton Hall, have species of national conservation concern. The presence of the RDB species, *Andrena ruficrus*, at Thornton Ellers and the discovery of *Bombus rupestris* at Brayton Barff are particularly significant.
4. Despite the isolation of the four sites, each site has about the number of solitary species expected in terms of the area of each site, although the number of high quality species probably is reduced.
5. Cleptoparasitic loads support the hypothesis of Wcislo.
6. Aerial nesters are particularly significant at Ringhay Wood with Lotherton Hall.

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Appendix

The list of aculeate wasps and bees recorded from Brayton Barff (BB), Ringhay Wood with Lotherton Hall (RW), South Cliffe Common (SC) and Thornton Ellers (TE).

Chrysididae: *Omalus auratus* (Linn.) (SC, TE), *Hedychridium ardens* (Latreille *in* Coquebert) (SC, TE), *Chrysis angustula* Schenck (RW, TE), *C. ignita* (Linn.) (RW, TE), *C. impressa* Schenck (BB, RW, SC, TE), *C. viridula* Linn. (BB), *Trichrysis cyanea* (Linn.) (RW, SC, TE).

Mutillidae: *Myrmosa atra* Panzer (BB, SC, TE).

Pompilidae: *Anoplius nigerrimus* Dufour (RW), *Arachnospila anceps* (Wesmael) (BB, SC, TE), *A. spissa* (Schiødte) (SC, TE), *Dipogon subintermedius* (Magretti) (= *nitidus*) (BB, RW, SC, TE), *Episyron rufipes* (Linn.) (SC, TE), *Evagetes crassicornis* (Shuchard) (BB, SC, TE), *Pompilus cinereus* (Fab.) (SC), *Priocnemis exaltata* (Fab.) (SC, TE), *P. fennica* Haupt (RW), *P. parvula* Dahlbom (TE), *P. perturbator* (Harris) (TE), *P. schioedtei* Haupt (SC).

Eumeninae: *Odynerus spinipes* (Linn.) (BB), *Ancistrocerus gazella* (Panzer) (BB), *A. oviventris* (Wesmael) (BB), *A. parietinus* (Linn.) (BB), *A. trifasciatus* (Müller) (RW, TE), *Symmorphus bifasciatus* (Linn.) (= *mutinensis*) (TE), *S. gracilis* (Brullé) (SC, TE).

Vespinae: *Vespa crabro* Linn. (BB), *Dolichovespula media* (Retzius) (RW), *D. norwegica* (Fab) (RW, SC), *D. sylvestris* (Scopoli) (BB, RW, SC, TE), *Paravespula germanica* (Fab.) (BB, RW, SC, TE), *P. vulgaris* (Linn.) (BB, RW, SC, TE), *Vespula rufa* (Linn.) (RW, SC, TE).

Sphecidae: *Astata pinguis* (Dahlbom) (BB, SC), *Tachysphex pompiliformis* (Panzer) (BB, SC, TE), *Trypoxylon attenuatum* Smith (SC), *T. clavicerum* Lepeletier & Serville (BB, RW), *T. figulus* (Linn.) (RW, SC, TE), *Crabro cribrarius* (Linn.) (BB, SC, TE), *C. peltarius* (Schreber) (BB, SC), *Crossocerus annulipes* (Lepeletier & Brullé) (RW), *C. capitosus* (Shuckard) (TE), *C. cetratus* (Shuckard) (RW), *C. dimidiatus* (Fab.) (RW), *C. elongatulus* (Vander Linden) (RW), *C. megacephalus* (Rossi) (RW, SC), *C. ovalis* (Lepeletier & Brullé) (BB, SC, TE), *C. podagricus* (Vander Linden) (BB, RW), *C. pusillus* (Lepeletier & Brullé) (BB, SC), *C. quadrimaculatus* (Fab.) (BB, SC, TE), *C. tarsatus* (Shuckard) (SC, TE), *C. wesmaeli* (Vander Linden) (SC), *Ectemnius cavifrons* (Thomson) (RW, SC, TE), *E. cephalotes* (Olivier) (BB, RW), *E. dives* (Lepeletier & Brullé) (SC), *Lindenius albilabris* (Fab.) (TE), *Rhopalum clavipes* (Linn.) (RW), *R. coarctatum* (Scopoli) (TE), *Oxybelus uniglumis* (Linn.) (BB, SC, TE), *Mimumesa dahlbomi* (Wesmael) (BB, SC, TE), *Mimesa equestris* (Fab.) (BB, SC), *M. lutaria* (Fab.) (SC), *Psenulus concolor* (Dahlbom) (TE), *P. pallipes* (Panzer) (BB, RW), *Pemphredon inornata* Say (RW, SC, TE), *P. lethifera* (Shuckard) (TE), *P. lugubris* (Fab.) (BB, RW, SC), *Diodontus luperus* Shuckard (BB), *D. minutus* (Fab.) (SC, TE), *D. tristis* (Vander Linden) (SC, TE), *Passaloecus corniger* Shuckard (BB, RW), *P. gracilis* Shuckard (RW), *P. singularis* Dahlbom (BB), *Ammophila sabulosa* (Linn.), (BB, SC, TE), *Mellinus arvensis* (Linn.) (BB, SC, TE), *Nysson spinosus* (Forster) (BB, TE), *N.*

trimaculatus (Rossi) (TE), *Gorytes quadrifasciatus* (Fab.) (BB, TE), *G. tumidus* (Panzer) (SC), *Argogorytes mystaceus* (Linn.) (BB, TE),

Colletinae: *Colletes daviesanus* Smith (BB, TE), *C. succinctus* (Linn.) (SC), *Hylaeus communis* Nylander (BB, RW, SC, TE).

Andreninae: *Andrena angustior* (Kirby) (BB), *A. barbilabris* (Kirby) (BB, SC), *A. bicolor* Fab. (RW), *A. chrysosceles* (Kirby) (BB, RW, SC, TE), *A. cineraria* (Linn.) (BB, SC, TE), *A. clarkella* (Kirby) (SC, TE), *A. denticulata* (Kirby) (BB), *A. fucata* Smith (RW), *A. fulva* (Müller *in* Allioni) (BB, RW, TE), *A. fuscipes* (Kirby) (SC), *A. haemorrhoa* (Fab.) (BB, RW, SC, TE), *A. helvola* (Linn.) (RW), *A. lapponica* Zetterstedt (SC), *A. minutula* (Kirby) (BB, RW), *A. nigroaenea* (Kirby) (BB, RW, SC, TE), *A. ruficrus* Nylander (TE), *Andrena semilaevis* Pérez (= *saundersella*) (BB), *A. scotica* Perkins (BB, RW, SC, TE), *A. subopaca* Nylander (BB, RW), *A. wilkella* (Kirby) (BB).

Halictinae: *Halictus rubicundus* (Christ) (BB, RW, SC, TE), *H. tumulorum* (Linn.) (BB, RW), *Lasioglossum albipes* (Fab.) (BB, RW), *L. calceatum* (Scopoli) (BB, TE), *L. cupromicans* (Pérez) (RW), *L. fratellum* (Pérez) (RW, SC), *L. fulvicorne* (Kirby) (RW), *L. leucopum* (Kirby) (BB, RW, TE), *L. leucozonium* (Schrank) (BB), *L. rufitarse* (Zetterstedt) (RW, SC, TE), *L. smeathmanellum* (Kirby) (RW), *L. villosulum* (Kirby) (BB, SC, TE), *Sphecodes ephippius* (Linn.) (BB), *S. geoffrellus* (Kirby) (= *fasciatus*) (BB, SC, TE), *S. gibbus* (Linn.) (BB, SC, TE), *S. hyalinatus* von Hagens (RW, TE), *S. monilicornis* (Kirby) (BB, SC, TE), *S. pellucidus* Smith (BB, SC, TE), *S. puncticeps* Thomson (BB, TE).

Megachilinae: *Chelostoma florisomne* (Linn.) (BB, RW), *Megachile versicolor* Smith (TE), *Megachile willughbiella* (Kirby) (BB, SC), *Osmia caerulescens* (Linn.), (BB, TE), *O. leaiana* (Kirby) (RW), *O. rufa* (Linn.) (BB, RW, TE).

Anthophorinae: *Nomada fabriciana* (Linn.) (BB, RW), *N. flavoguttata* (Kirby) (RW), *N. goodeniana* (Kirby) (BB, RW, SC, TE), *N. integra* Brullé (= *pleurosticta*) (BB), *N. lathburiana* (Kirby) (BB, TE), *N. leucophthalma* (Kirby) (RW, SC, TE), *N. marshamella* (Kirby) (BB, RW, SC, TE), *N. panzeri* Lepeletier (BB, RW, TE), *N. ruficornis* (Linn.) (RW, TE), *N. rufipes* Fab. (SC), *N. striata* Fab. (BB) *Epeolus cruciger* (Panzer) (SC), *Anthophora furcata* (Panzer) (RW), *A. plumipes* (Pallas) (SC).

Apinae: *Bombus hortorum* (Linn.) (RW, SC, TE), *B. lapidarius* (Linn.) (BB, RW, SC, TE), *B. lucorum* (Linn.) (BB, RW, SC, TE), *B. pascuorum* (Scopoli) (BB, RW, SC, TE), *B. pratorum* (Linn.) (BB, RW, SC, TE), *B. terrestris* (Linn.) (BB, RW, SC, TE), *B. bohemicus* (Seidl) (BB, RW, SC, TE), *B. campestris* (Panzer) (BB), *B. rupestris* (Fab.) (BB), *B. sylvestris* (Lepeletier) (BB, RW), *B. vestalis* (Geoffroy *in* Fourcroy) (BB, RW, SC), *Apis mellifera* Linn. (BB, RW, SC, TE).

ENTOMOLOGICAL REPORT: DIPTERA (TIPULOIDEA AND EMPIDOIDEA)

ROY CROSSLEY

Introduction

The last Report under the above heading was published in 2001 (*Naturalist* **126:** 193-196). Since then Derek Whiteley has kindly sent me a comprehensive set of dolichopodid records from the Sheffield Museum database and Andy Godfrey has loaned a substantial number of site reports and details of identifications he has undertaken in the past ten years or more. I have been able to extract much information for the Y.N.U. records from these two sources, and I am grateful to both colleagues for their support. Records have also been received from J. D. Coldwell, J. H. Cole, W. R. Dolling, C. M. Drake, W. A. Ely, A. Grayson, I. Perry, A. E. Stubbs and P. Talbot, to all of whom I express my thanks. The more significant ones are included in this Report; unattributed records are those of the writer. New County records are indicated by †, and Vice-County records by *.